Service Supplement

CUSTOMER SUPPORT

SSU05341-1

930215
4822 872 09431

Related to: **PM3350A/52A/55/57** *SERVICE MANUAL 4822 872 05341*

Already published for this manual: ---

Subject:
Service Manual update: new P2CCD unit lay-out PM3355/57 + small adaptations of circuitry

This supplement contains the modified circuit diagrams, printed circuit board lay-outs and parts lists for the P2CCD unit A18 such as used in PM3355 and PM3357. The unit information is given in chapter 19 of the Service Manual; the parts list information in chapter 25.

The new unit A18 lay-out is approximately valid for serial number DM 543 .... and onwards.

To update the Service Manual, the affected pages have to be exchanged with the pages in this supplement.

The partslist includes mainly changed components on unit A18; also changed components on other units in the instrument are listed.

1 COMPLETION/CORRECTION OF PARTS LIST.

C1019, C1119	Capacitor	33pF	5322 126 12228
C1028, C1128	Capacitor	27pF	5322 126 12227
C1022, C1122	Capacitor	22pF	5322 126 12226
C1139	Capacitor	1p8	5322 122 32313
C2052	Capacitor	1p5	5322 122 32101
C2317, C2321	Capacitor	6p8	5322 122 32269
C2605	Capacitor	10n	4822 122 31414
C5960	Capacitor	47pF	5322 122 32452
C5970	Capacitor	1n5	4822 122 33174

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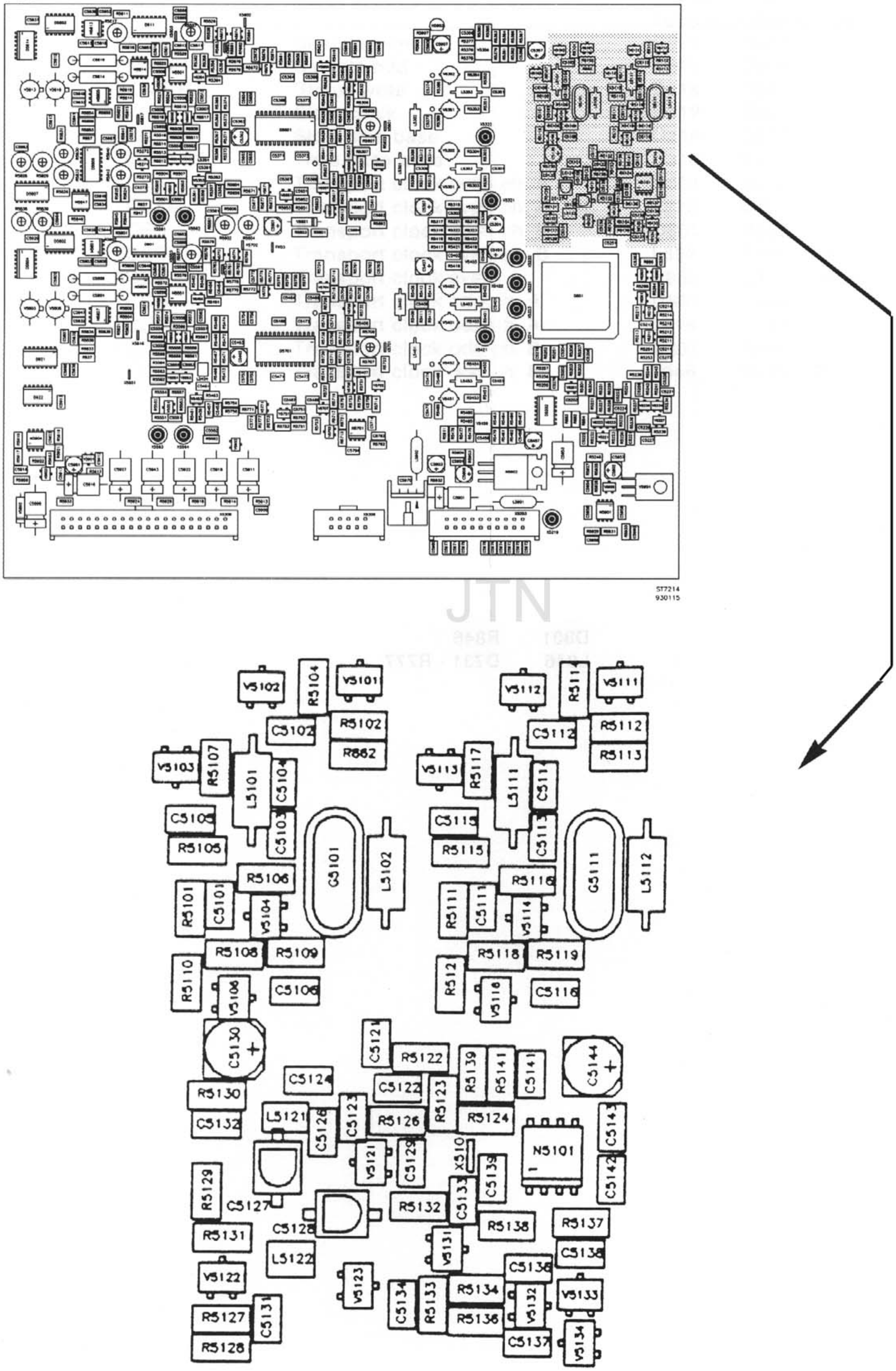
R224	Resistor	1k	4822 050 21002
R588	Resistor	7k15	4822 050 27152
R724	Resistor	11k	4822 051 51103
R751, R781	Resistor	4k7	4822 051 10472
R1073	Resistor	6k81	4822 050 26812
R2205, R2210, R2215	Resistor	2k2	4822 051 10222
R2235, R2245	Resistor	46E4	4822 050 24649
R2250	Resistor	31E6	4822 050 23169
R2701	Resistor	21E5	4822 050 22159
R2702	Resistor	6E19	4822 050 26198
R3018	Resistor	3k48	4822 050 23482
R3036	Trim potm	220E	5322 105 20031
R4005	Resistor	1k	4822 050 21002
R5823, R5843	NTC res.	680E	4822 116 30268
R5826, R5846	Resistor	2k7	4822 051 10272
R5930	Resistor	200E	4822 051 52001
V2310	Transistor	BF324	4822 130 41448
V2603	Diode	BAW62	4822 130 30613
V2316, V2321, V2802	Transistor	BF550R	4822 130 60687
V5351, V5352	Transistor	BFR92	5322 130 42145
V5451, V5452	Transistor	BFR92	5322 130 42145
V5506, V5556	Transistor	BFR92	5322 130 42145
V5507, V5557	Transistor	BFR92R	5322 130 44713
L5354, L5454	Coil	RFC	5322 157 53597
D801	Integr. Circ.	OQ0206-N7 (PM3355/57)	5322 209 12411
D601, D602	Integr. Circ.	OQ0020-N3	5322 209 31611
D2801, D2303	Integr. Circ.	OQ0020-N3	5322 209 31611
D2801	Integr. Circ.	OQ0208	5322 209 12517

2 NEW CIRCUIT DIAGRAMS AND PRINTED CIRCUIT BOARD LAY-OUTS.

Signal name	Description	Signal source:	Signal destination(s):
SMPEV-HT	Sample even	D921	D914
SMPOD-HT	Sample odd	D921	D904
STWE-HT	Status write	D316	D801
SWCK	Slow clock	D412	D801
SWTB	Slow time base	D218	D801 - D412
TBWE-HT	Time base write	D316	D801
TCEA	Transport clock even ch. A	D801	R822
TCEAM	Transport clock even ch. A	L822	D731 - R747
TCEB	Transport clock even ch. B	D801	R852
TCEBM	Transport clock even ch. B	L852	D731 - R747
TCEV-LT	Transport clock even	R882	D401 - D408 - D411
TCOA	Transport clock odd ch. A	D801	R816
TCOAM	Transport clock odd ch. A	L816	D731 - R777
TCOB	Transport clock odd ch. B	D801	R846
TCOBM	Transport clock odd ch. B	L846	D731 - R777

Figure 19.7 Part of P^2CCD unit, part 1

A18



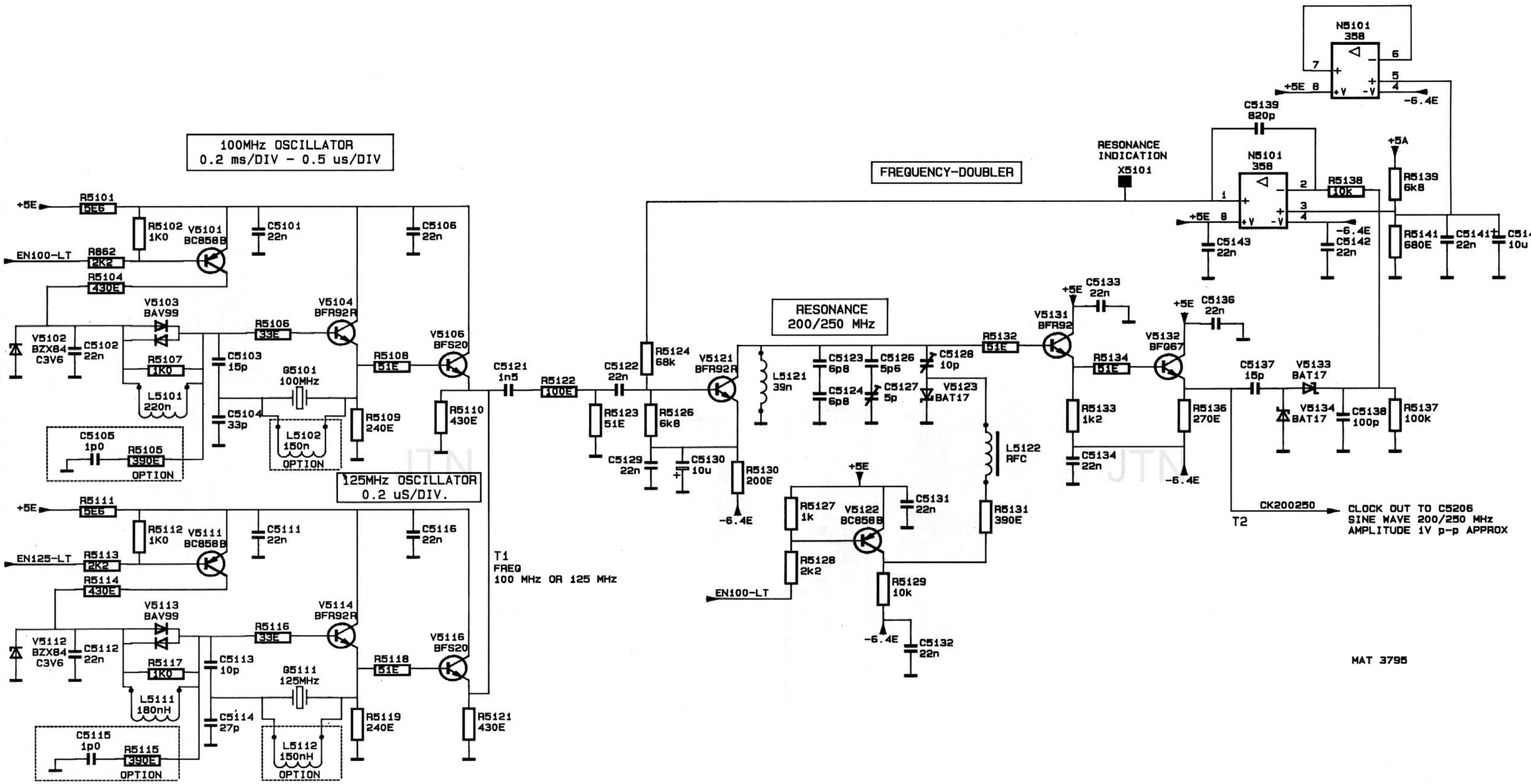


Figure 19-8 Circuit diagram of P^2CCD, oscillator circuit

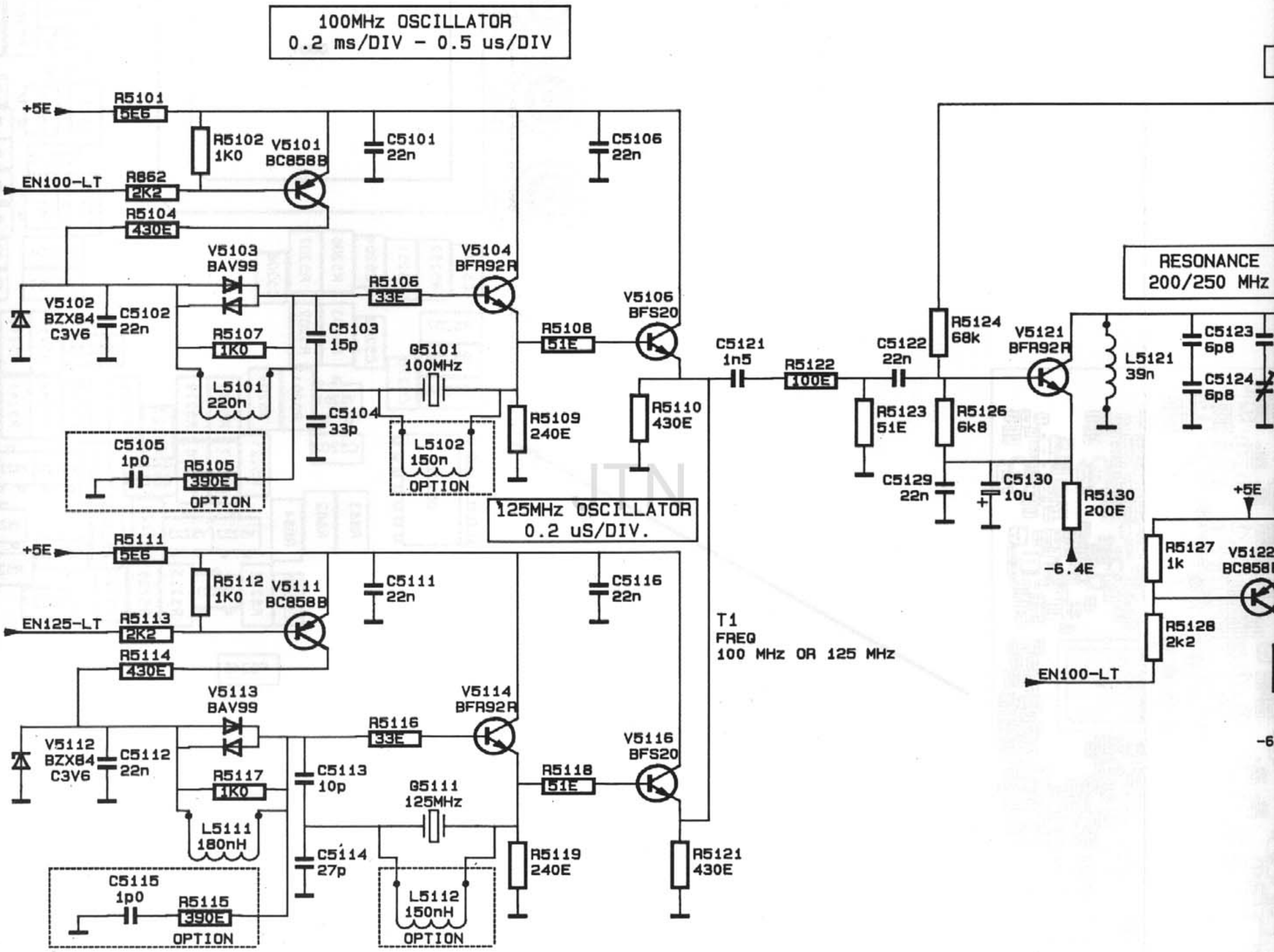


Figure 19-8 Circuit diagram of P^2CCD, oscillator circuit

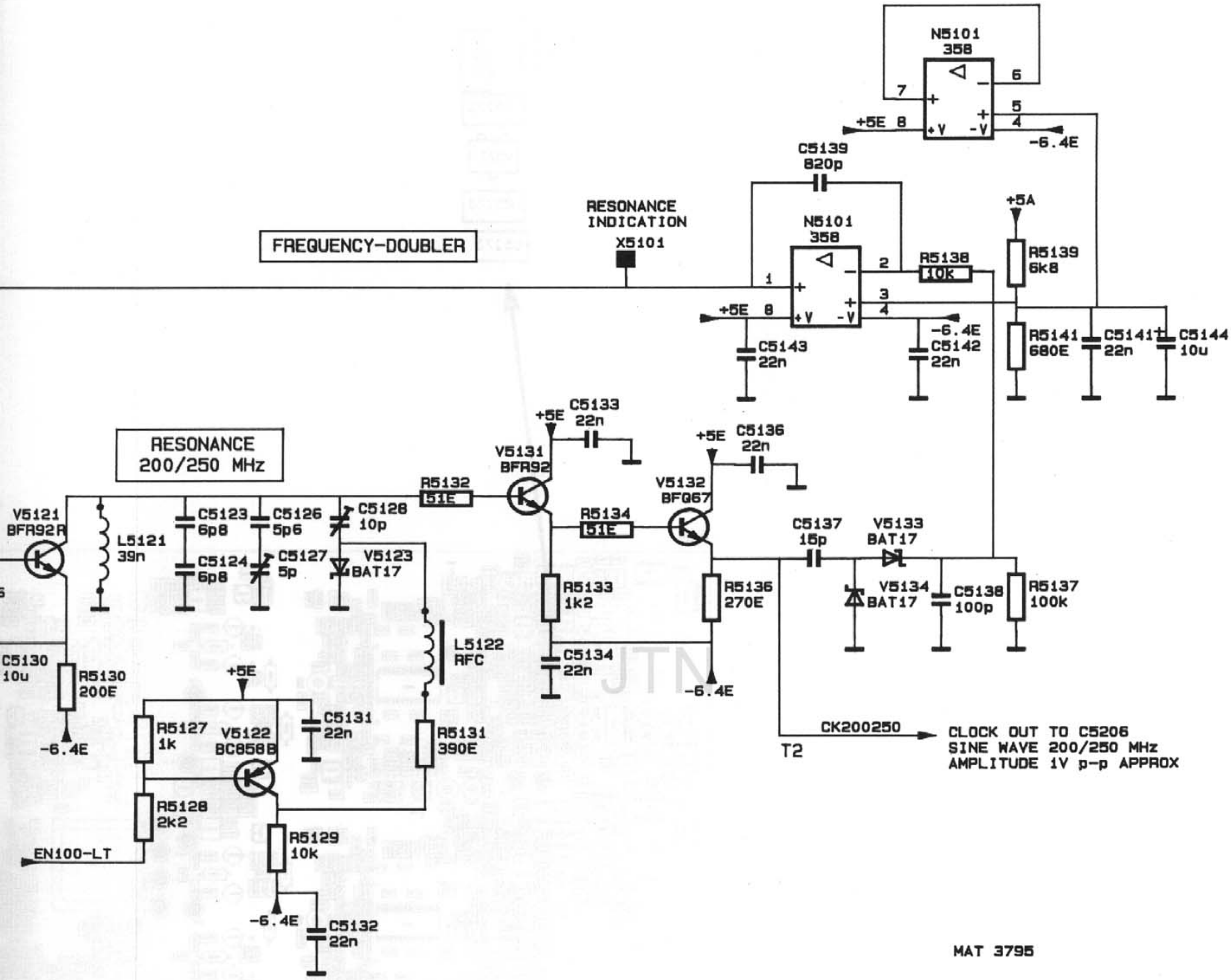
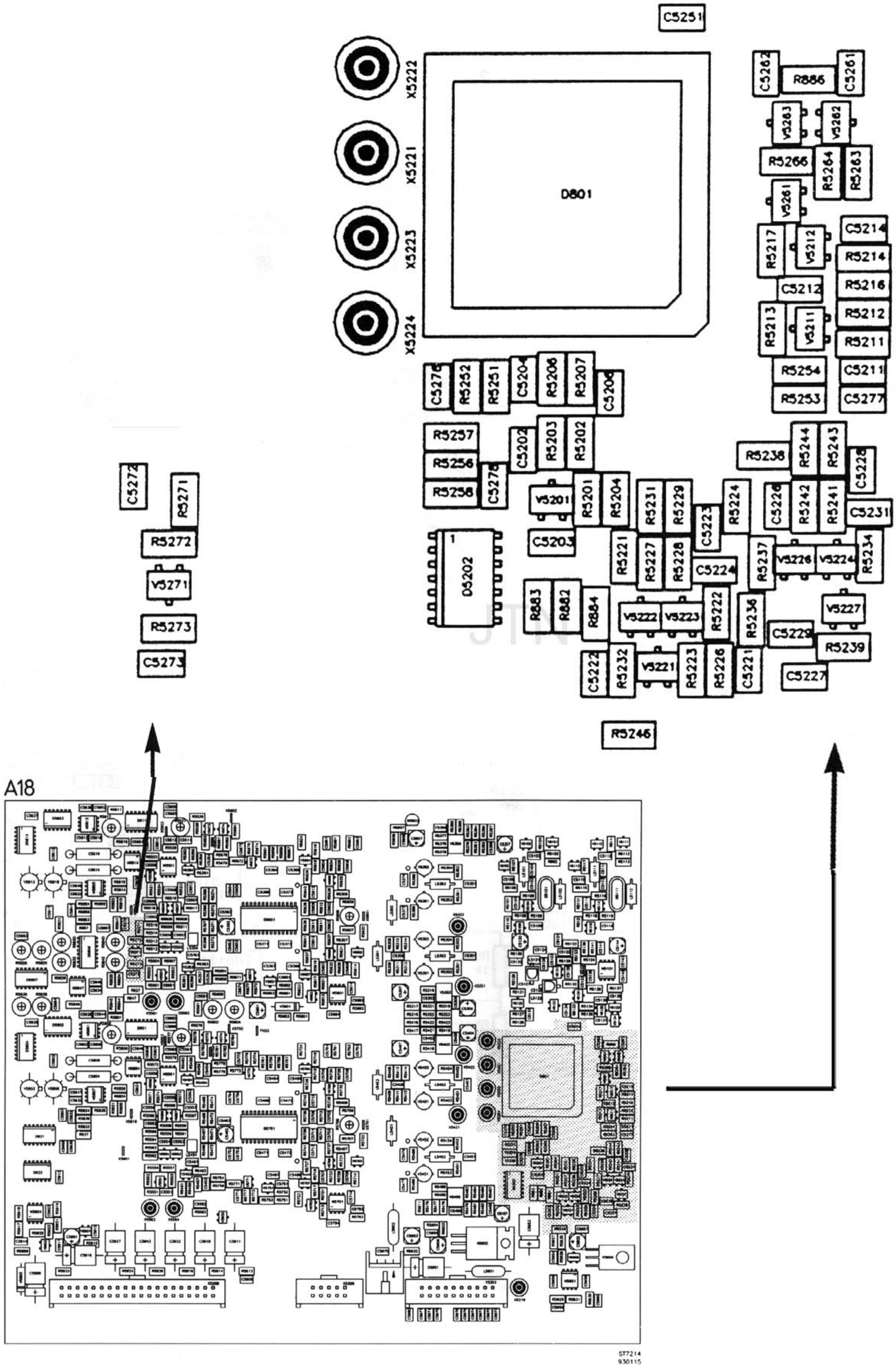

N5101
358
7
6
5
4
+5E 8
+V
-V
-6.4E
C5139
820p
RESONANCE
INDICATION
X5101
FREQUENCY-DOUBLER
N5101
358
2
1
3
4
R5138
10k
+5A
R5139
6k8
+5E 8
-6.4E
C5143
22n
C5142
22n
R5141
680E
C5141
22n
C5144
10u
+5E
C5133
22n
RESONANCE
200/250 MHz
V5131
BFR92
+5E
C5136
22n
V5132
BFQ67
R5132
51E
V5121
BFR92R
L5121
39n
C5123
6p8
C5124
6p8
C5126
5p6
C5127
5p
C5128
10p
V5123
BAT17
R5134
51E
C5137
15p
V5133
BAT17
V5134
BAT17
C5138
100p
R5137
100k
R5133
1k2
R5136
270E
L5122
RFC
C5134
22n
-6.4E
C5130
10u
R5130
200E
-6.4E
+5E
R5127
1k
V5122
BC858B
C5131
22n
R5131
390E
R5128
2k2
EN100-LT
R5129
10k
-6.4E
C5132
22n
CK200250
T2
CLOCK OUT TO C5206
SINE WAVE 200/250 MHz
AMPLITUDE 1V p-p APPROX
MAT 3795

Figure 19-9 Part of P^2CCD unit p.c.b., part 2



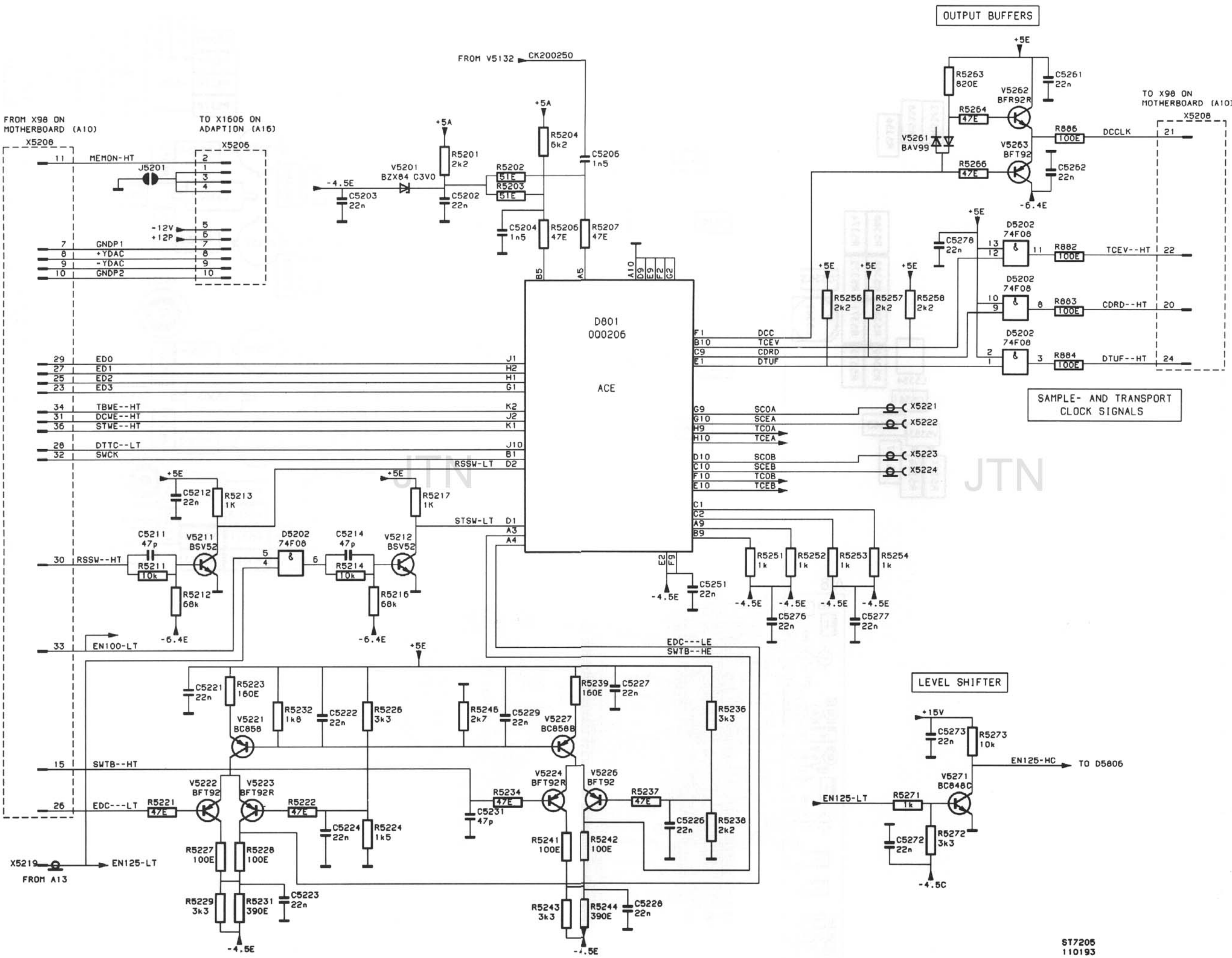


Figure 19.10 Circuit diagram of P^2CCD, ACE

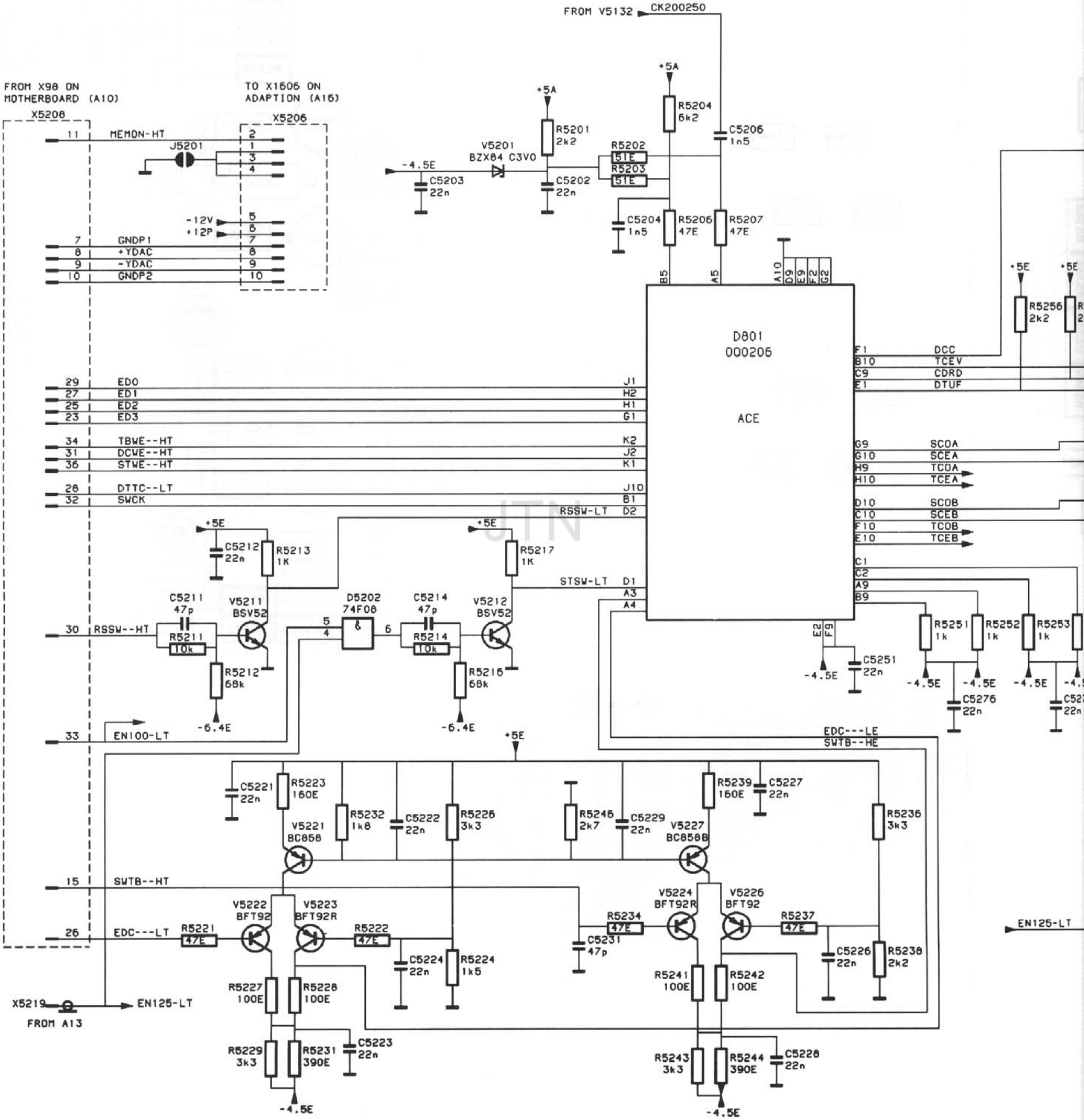
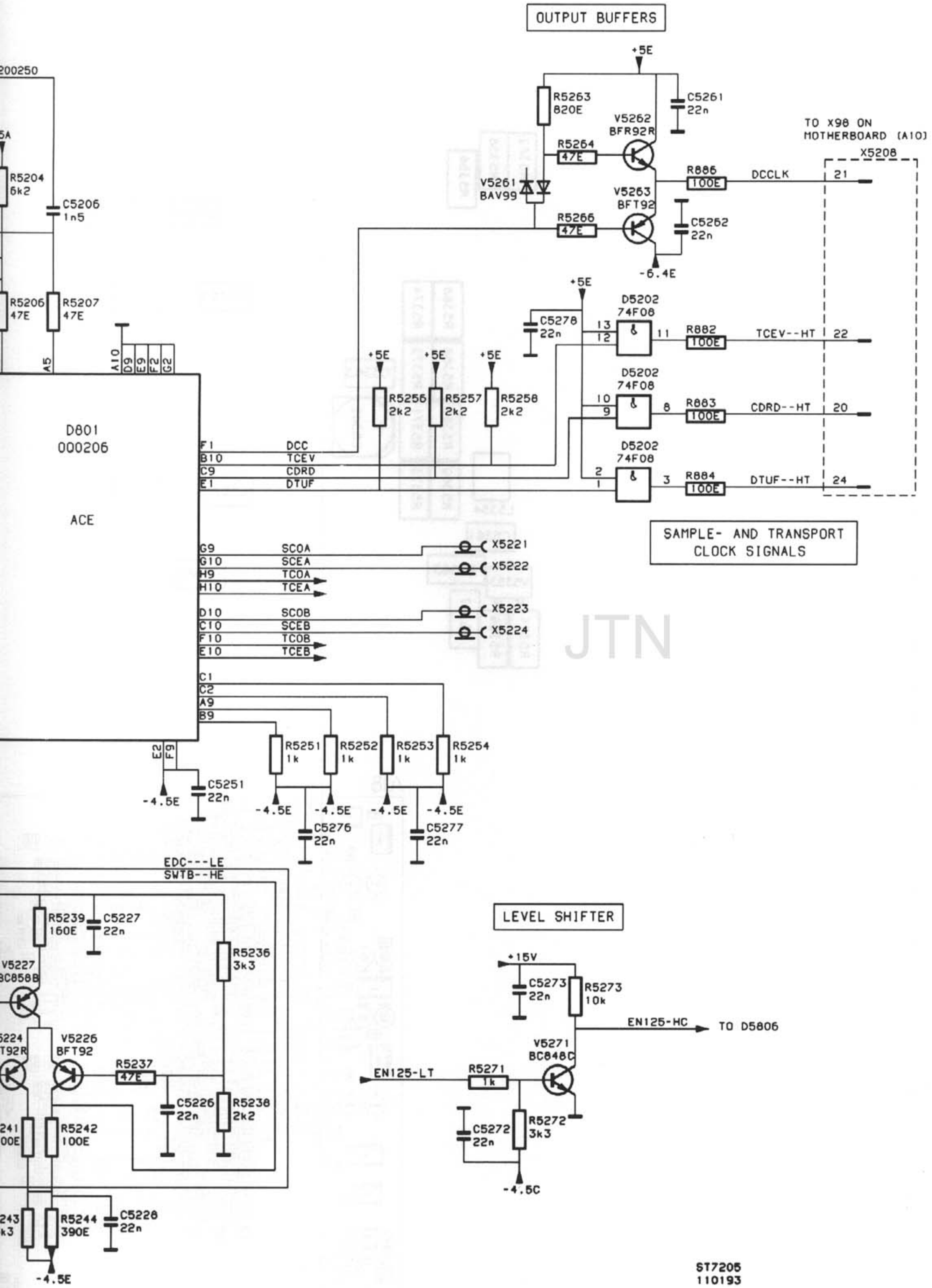


Figure 19.10 Circuit diagram of P²CCD, ACE


OUTPUT BUFFERS
+5E
R5263
820E
C5261
22n
V5262
BFR92R
TO X98 ON
MOTHERBOARD (A10)
X5208
R5264
47E
V5261
BAV99
R886
100E
DCCLK
21
V5263
BFT92
C5262
22n
R5266
47E
-6.4E
D5202
74F08
C5278
22n
R882
100E
TCEV--HT
22
R883
100E
CDRD--HT
20
R884
100E
DTUF--HT
24
R5256
2k2
R5257
2k2
R5258
2k2
D801
000206
ACE
DCC
TCEV
CDRD
DTUF
SAMPLE- AND TRANSPORT
CLOCK SIGNALS
SCOA
SCEA
TCOA
TCEA
X5221
X5222
SCOB
SCEB
TCOB
TCEB
X5223
X5224
R5251
1k
R5252
1k
R5253
1k
R5254
1k
C5251
22n
-4.5E
C5276
22n
C5277
22n
R5204
6k2
C5206
1n5
R5206
47E
R5207
47E
EDC---LE
SWTB--HE
R5239
160E
C5227
22n
R5236
3k3
V5227
BC858B
V5226
BFT92
R5237
47E
C5226
22n
R5238
2k2
R5242
100E
R5244
390E
C5228
22n
LEVEL SHIFTER
+15V
C5273
22n
R5273
10k
EN125-HC
TO D5806
V5271
BC848C
EN125-LT
R5271
1k
C5272
22n
R5272
3k3
-4.5C
ST7205
110193

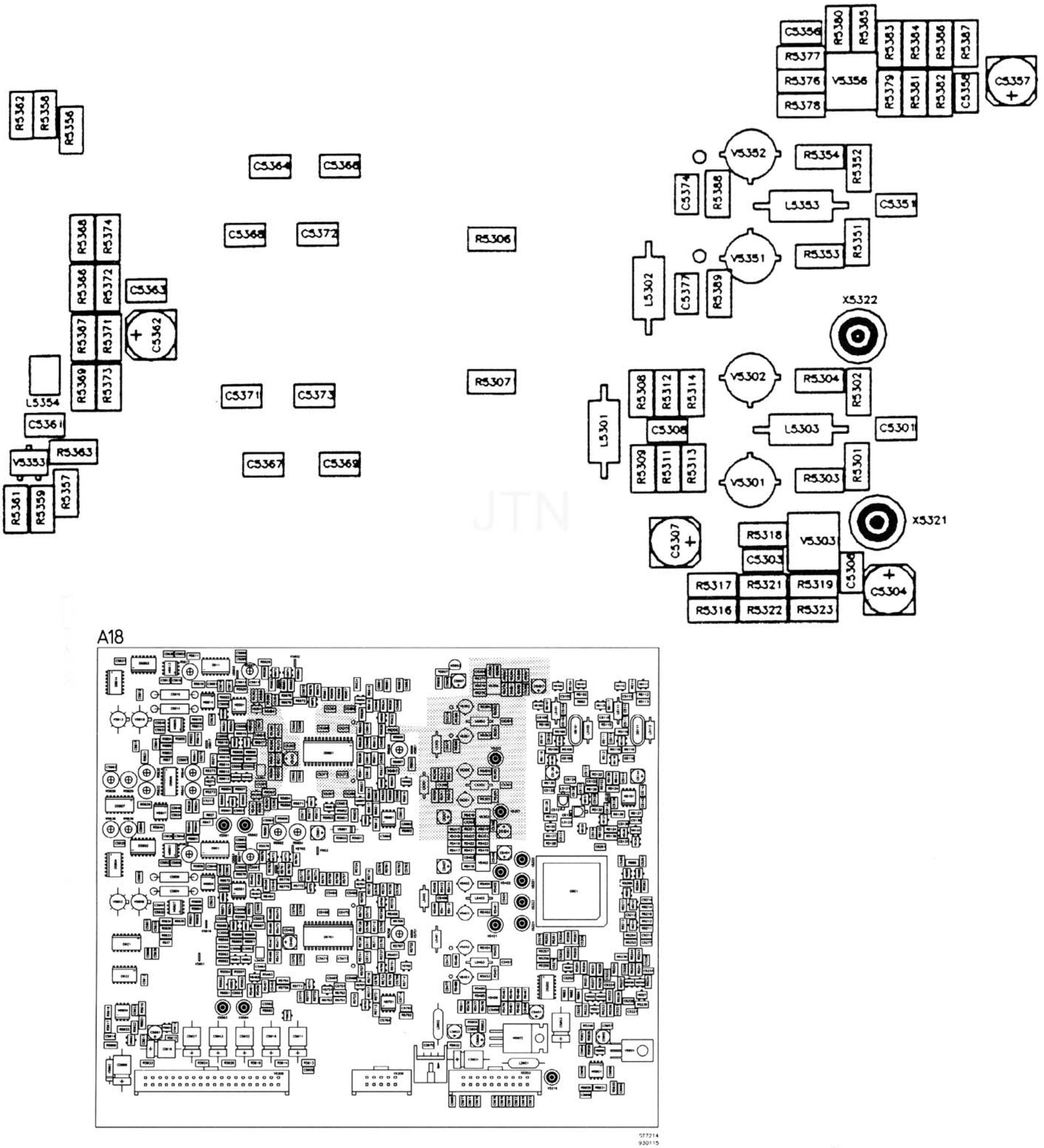
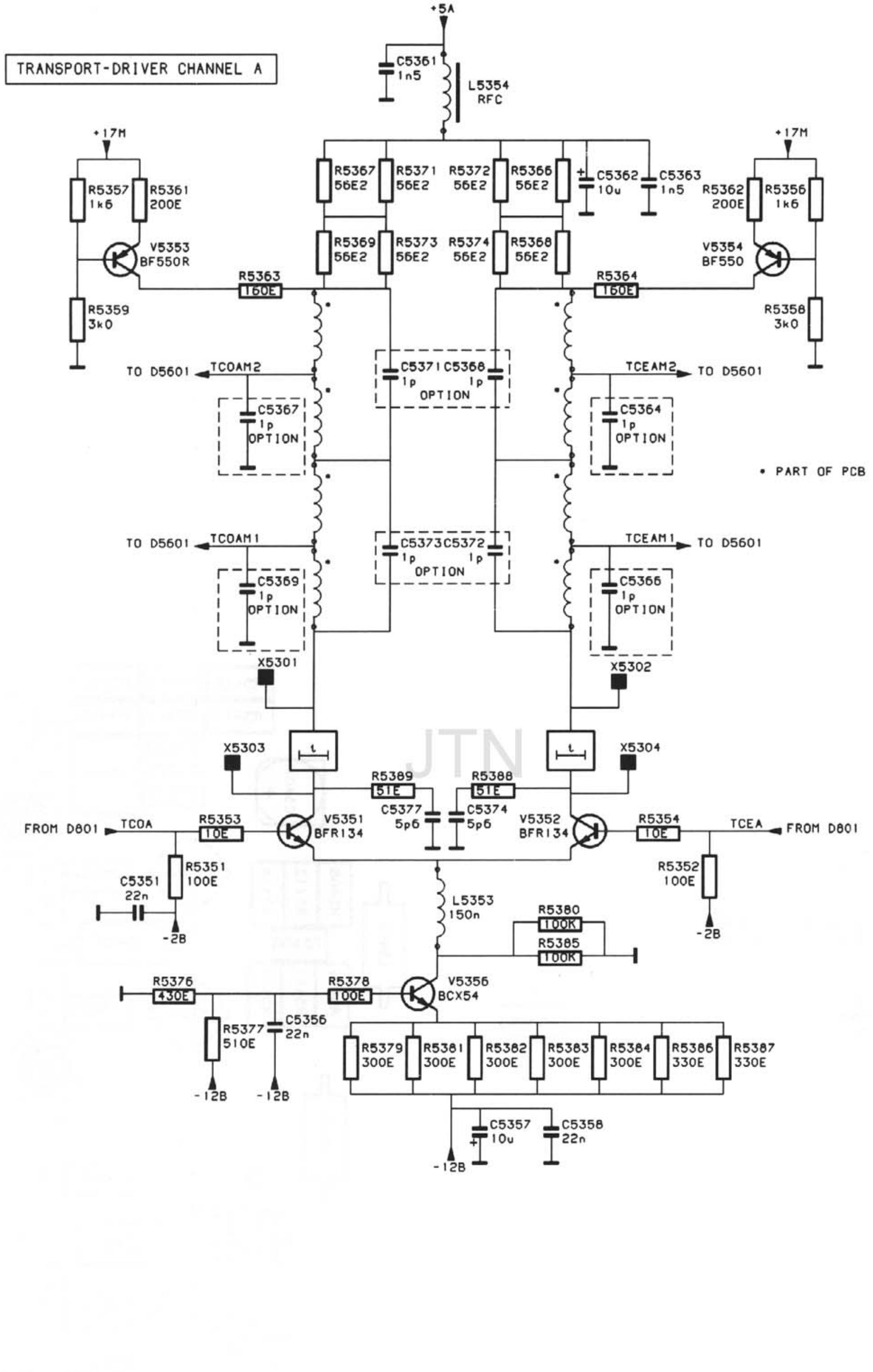


Figure 19.11 Part of P²CCD unit p.c.b., part 3



ST7206
110193

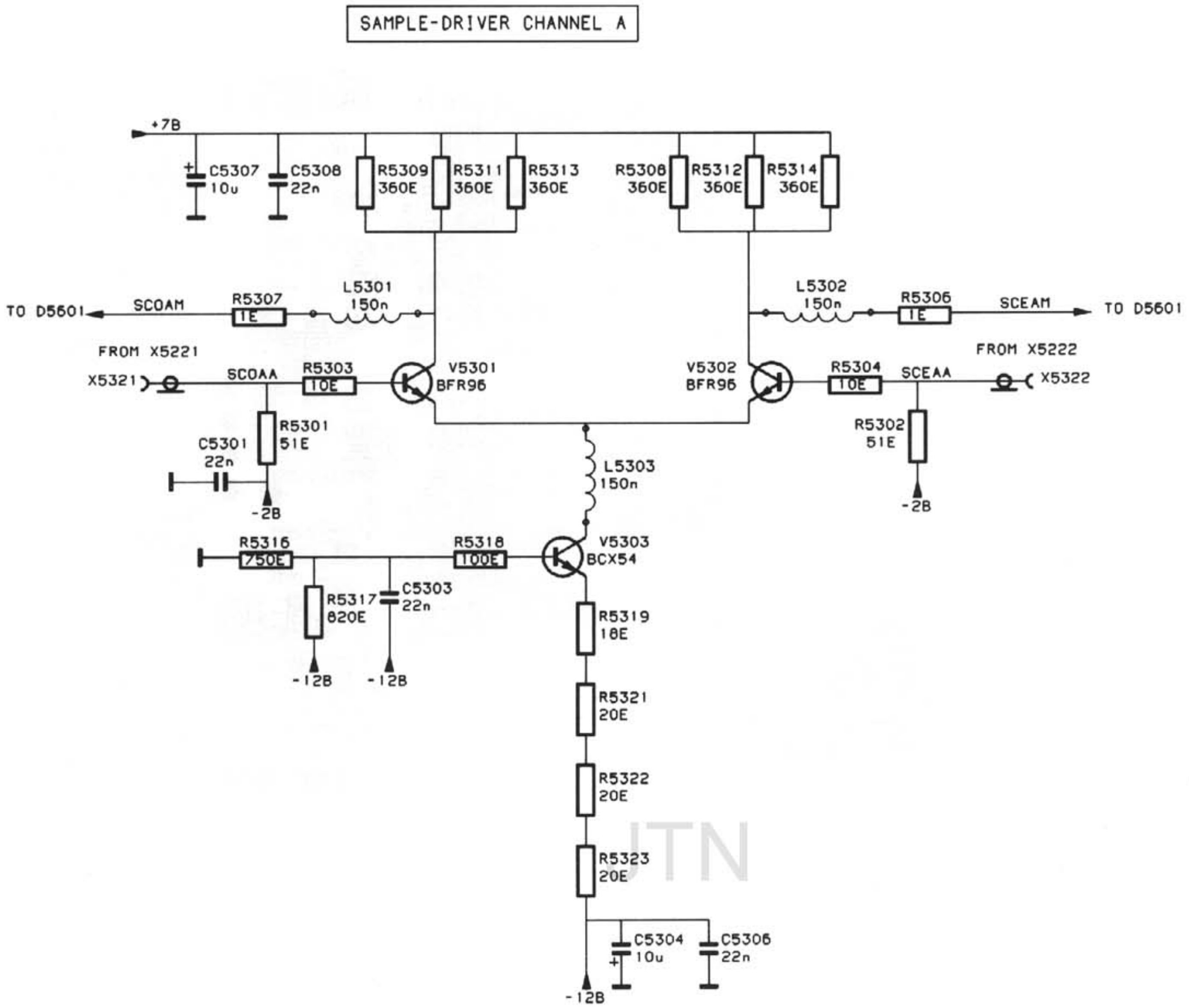
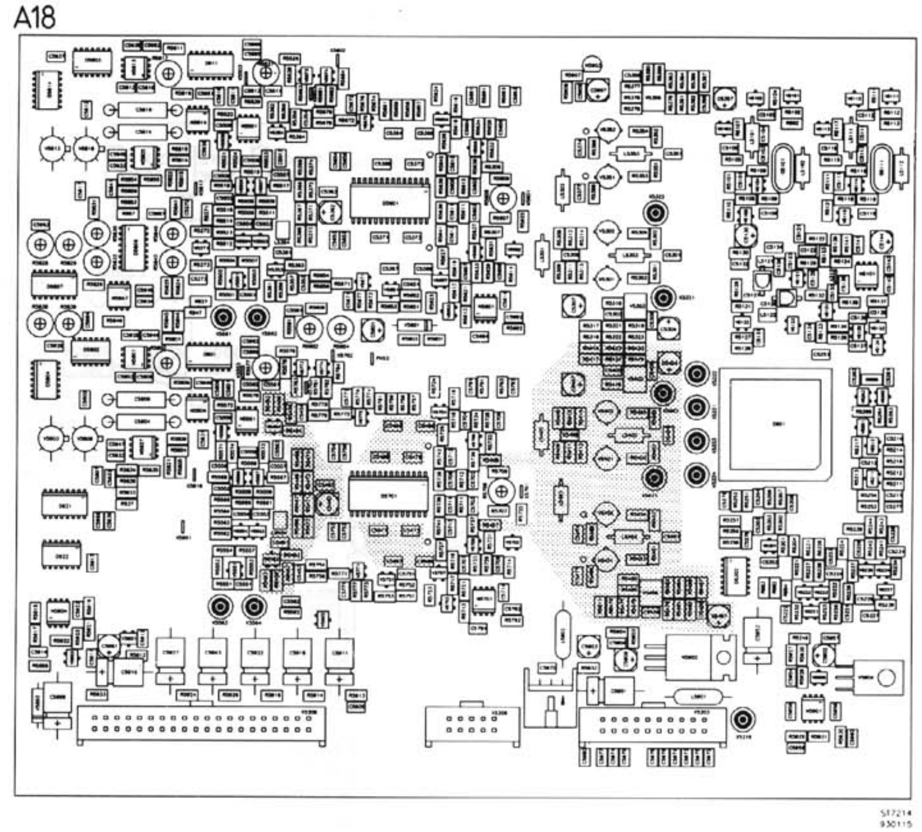


Figure 19-12 Circuit diagram of P^2CCD, clock drivers channel A



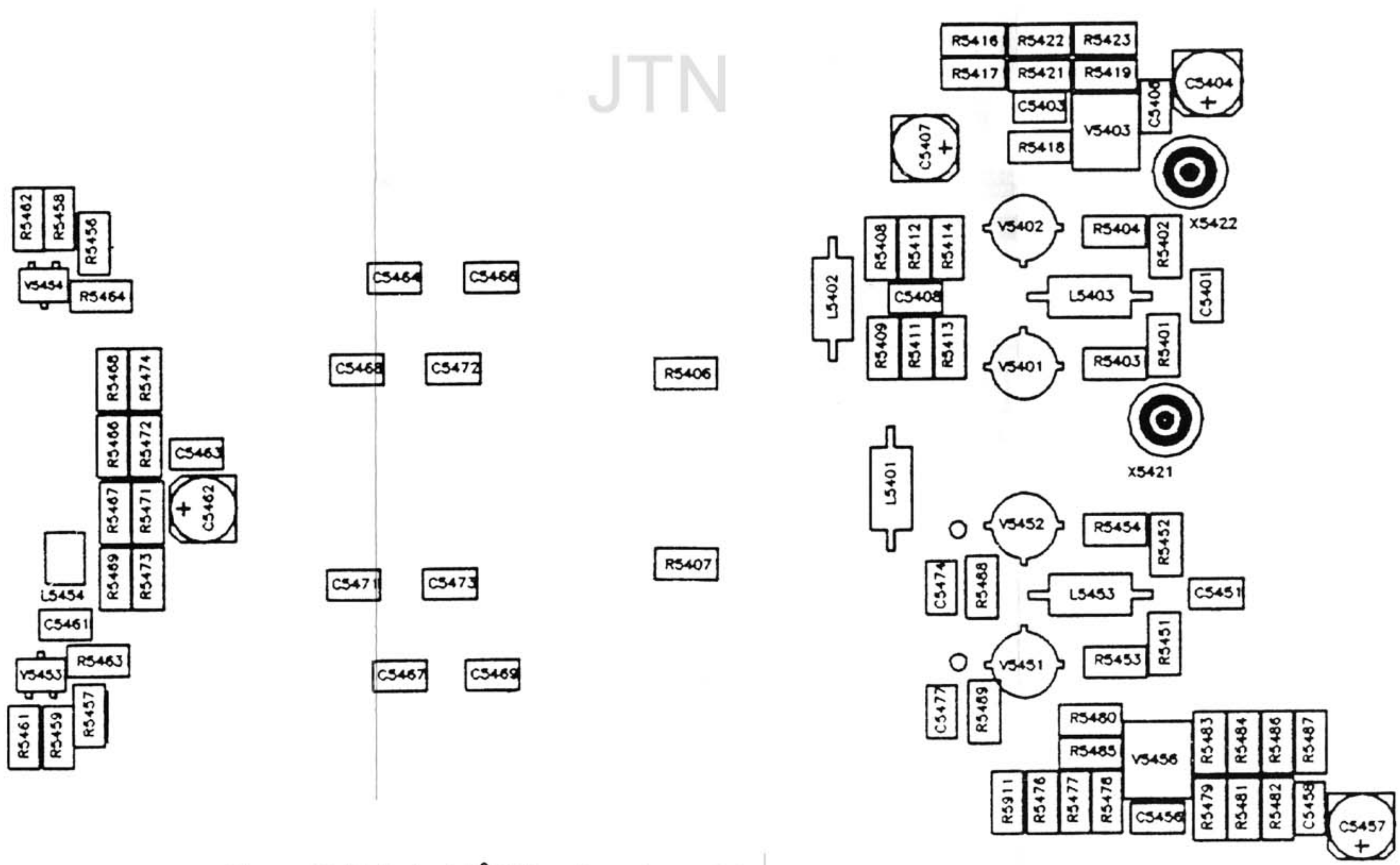


Figure 19.13 Part of P^2CCD unit p.c.b., part 4

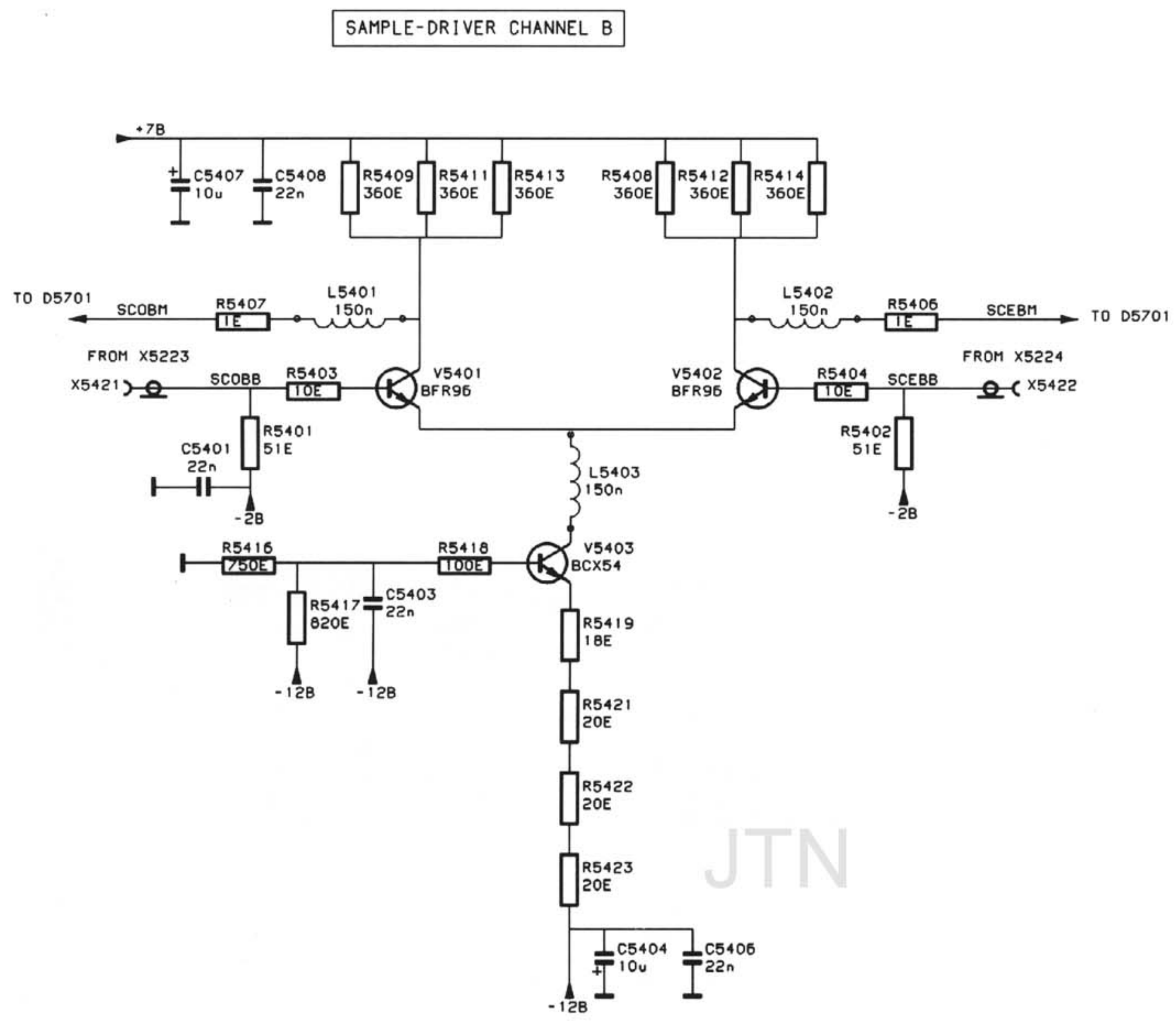
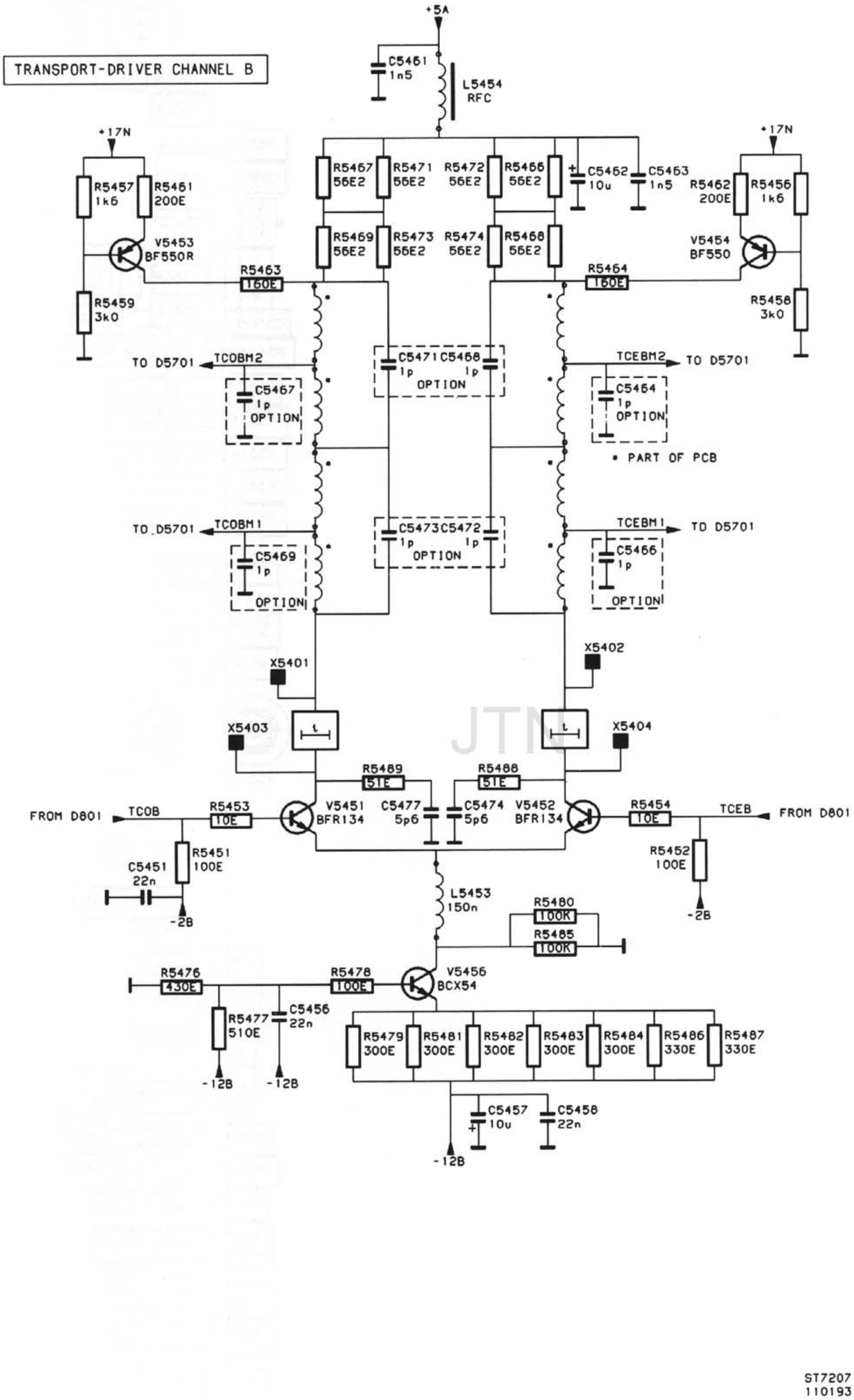
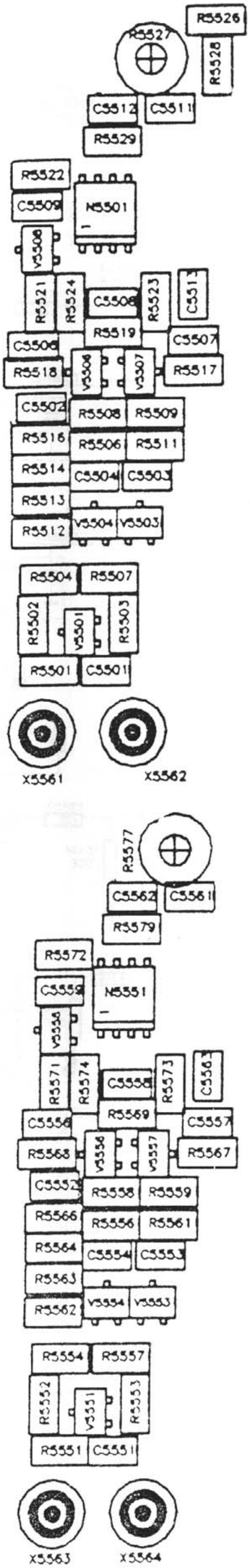


Figure 19.14 Circuit diagram of P²CCD, clock drivers channel B


TRANSPORT-DRIVER CHANNEL B
+5A
C5461 1n5
L5454 RFC
+17N
R5457 1k6
R5461 200E
V5453 BF550R
R5459 3k0
R5463 160E
R5467 56E2
R5471 56E2
R5472 56E2
R5466 56E2
C5462 10u
C5463 1n5
R5469 56E2
R5473 56E2
R5474 56E2
R5468 56E2
R5462 200E
R5456 1k6
V5454 BF550
R5464 160E
R5458 3k0
TO D5701
TCOBM2
C5467 1p OPTION
C5471 C5468 1p 1p OPTION
TCEBM2
C5464 1p OPTION
• PART OF PCB
TCOBM1
C5469 1p OPTION
C5473 C5472 1p 1p OPTION
TCEBM1
C5466 1p OPTION
X5401
X5402
X5403
X5404
R5489 51E
R5488 51E
FROM D801
TCOB
R5453 10E
V5451 BFR134
C5477 5p6
C5474 5p6
V5452 BFR134
R5454 10E
TCEB
R5451 100E
C5451 22n
-2B
R5452 100E
L5453 150n
R5480 100K
R5485 100K
R5476 430E
R5478 100E
V5456 BCX54
R5477 510E
C5456 22n
-12B
R5479 300E
R5481 300E
R5482 300E
R5483 300E
R5484 300E
R5486 330E
R5487 330E
C5457 10u
C5458 22n
ST7207
110193



A18

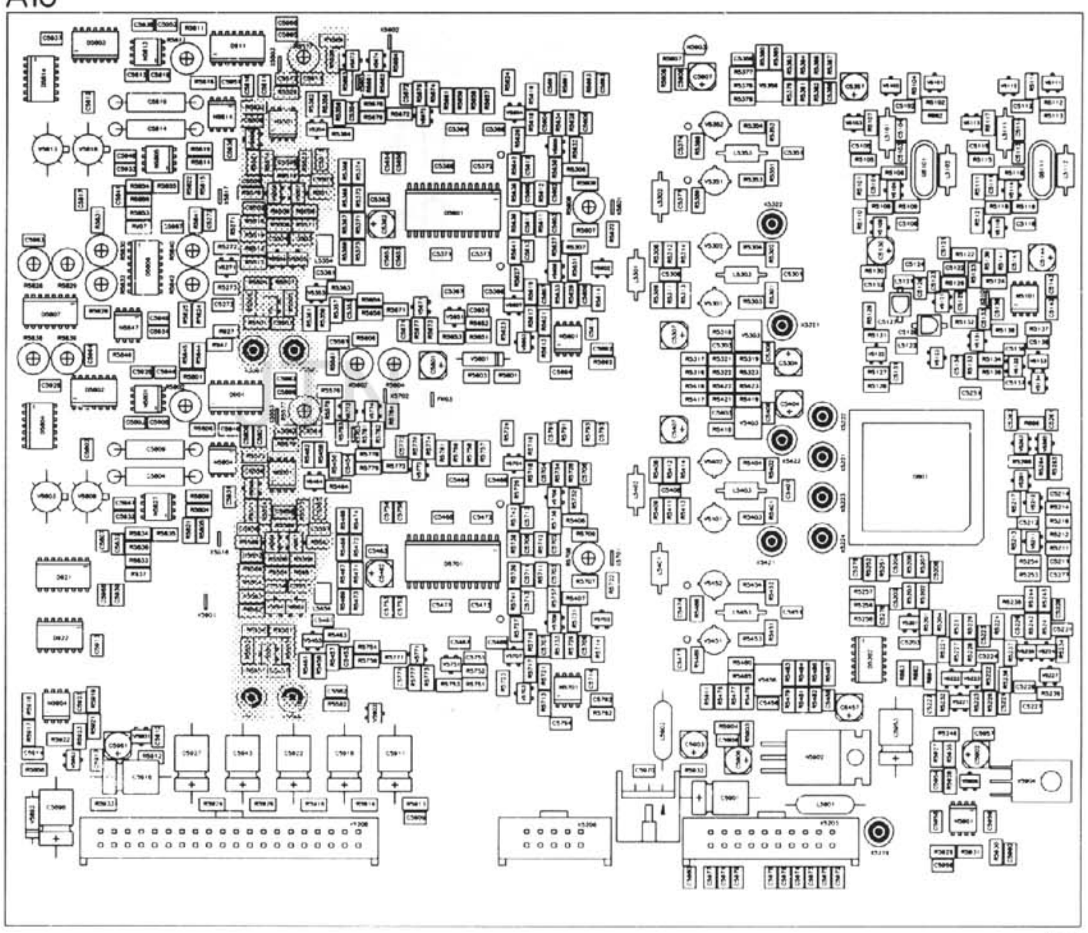


Figure 19.15 Part of P²CCD unit p.c.b., part 5

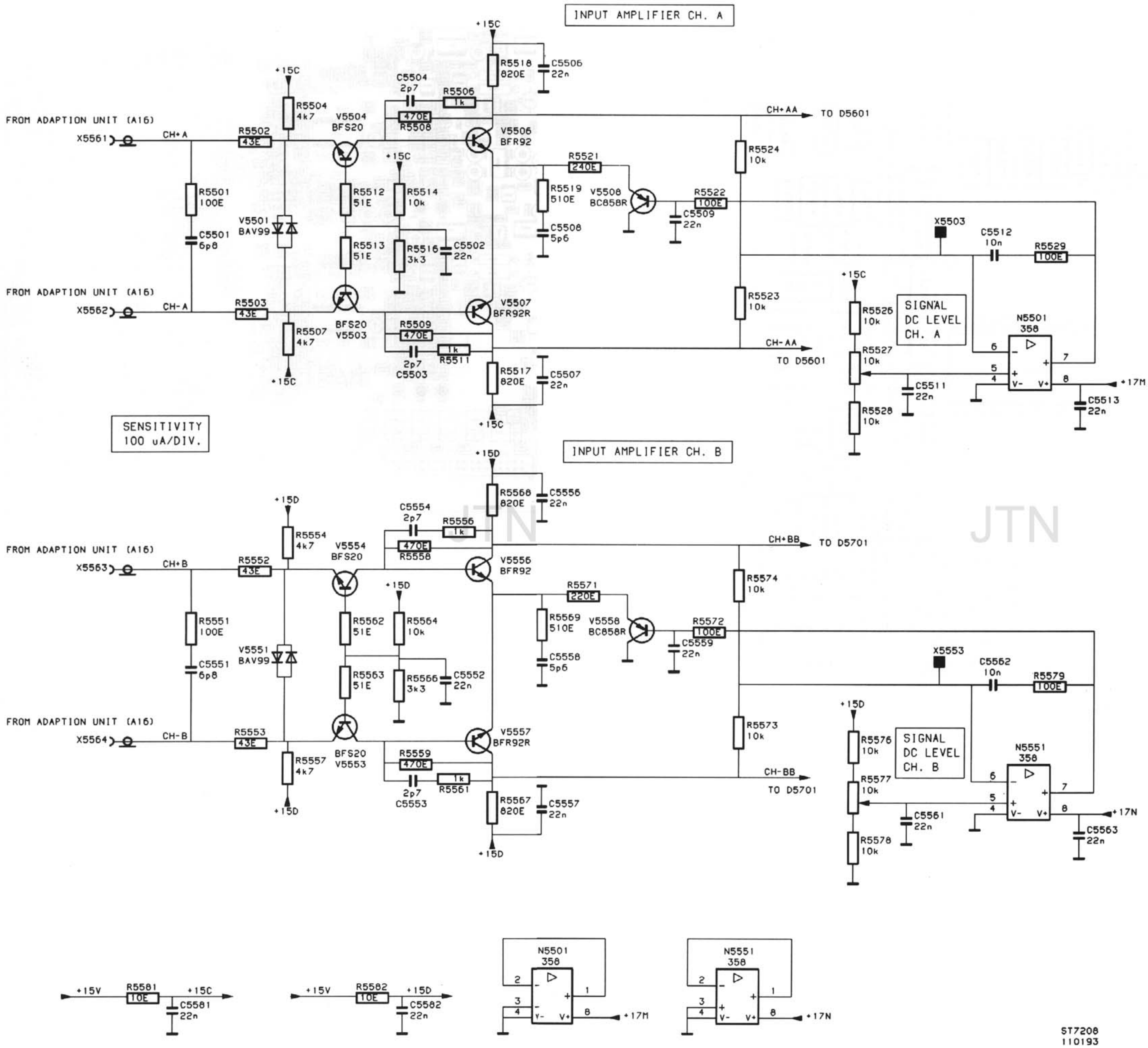
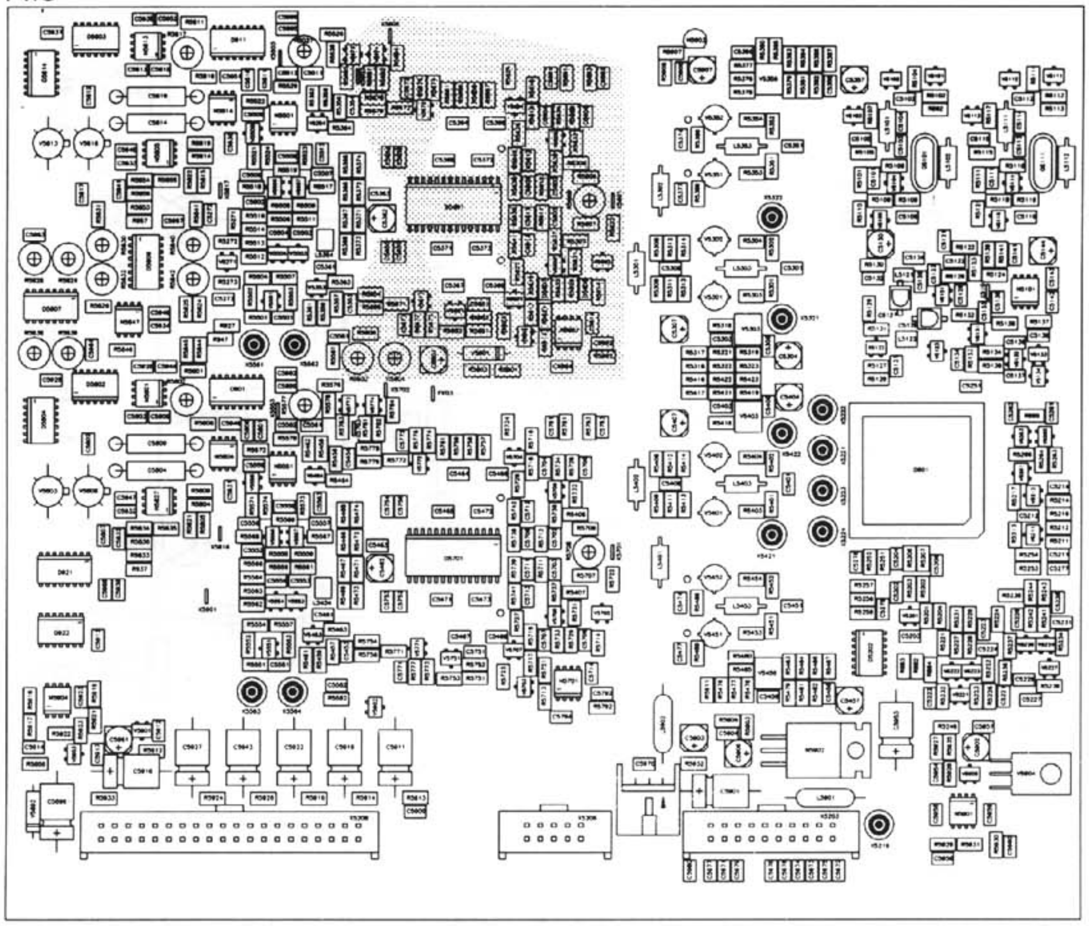


Figure 19.16 Circuit diagram of P^2CCD, input amplifiers

A18



ST7214
930115

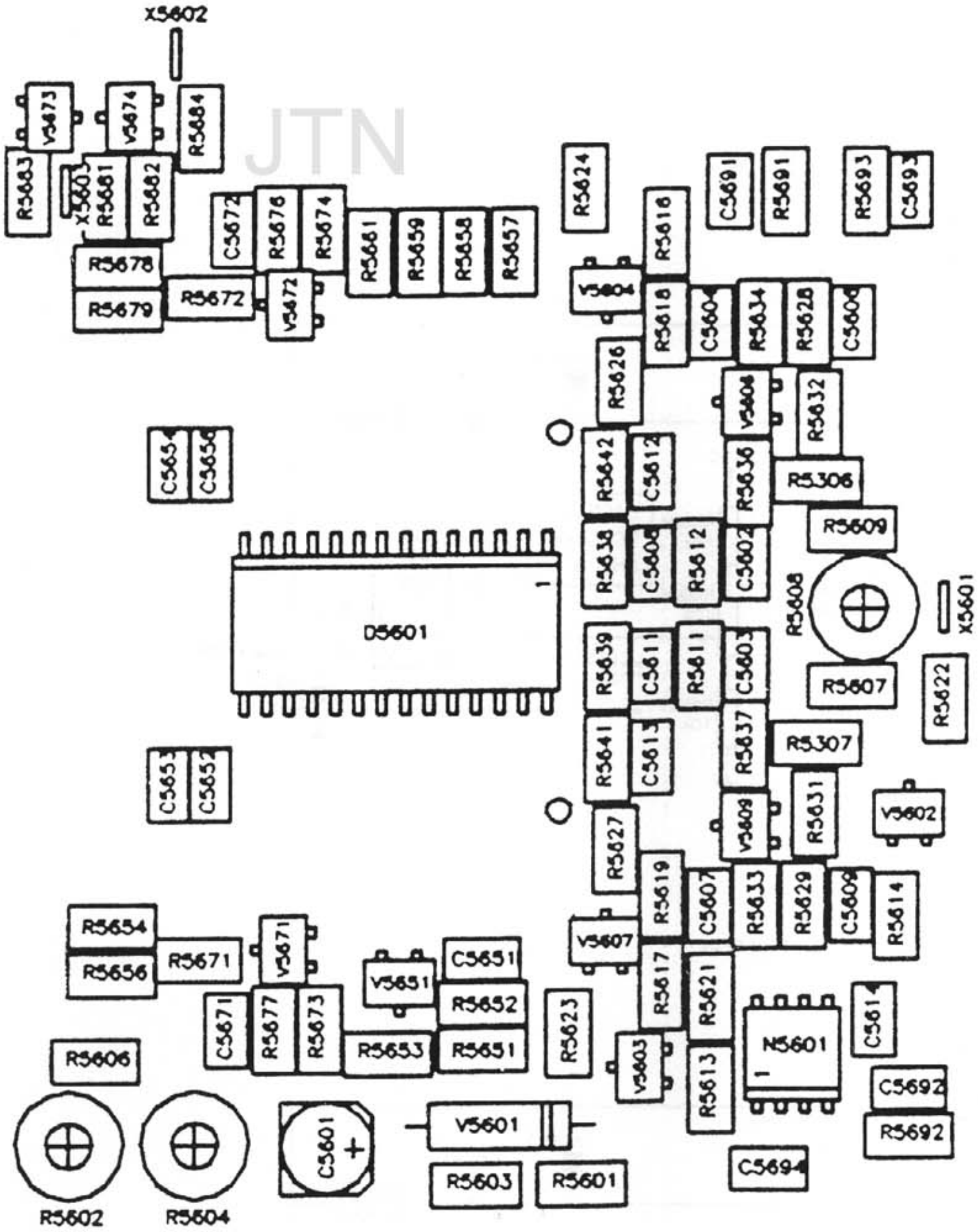


Figure 19.17 Part of P^2CCD unit p.c.b., part 6

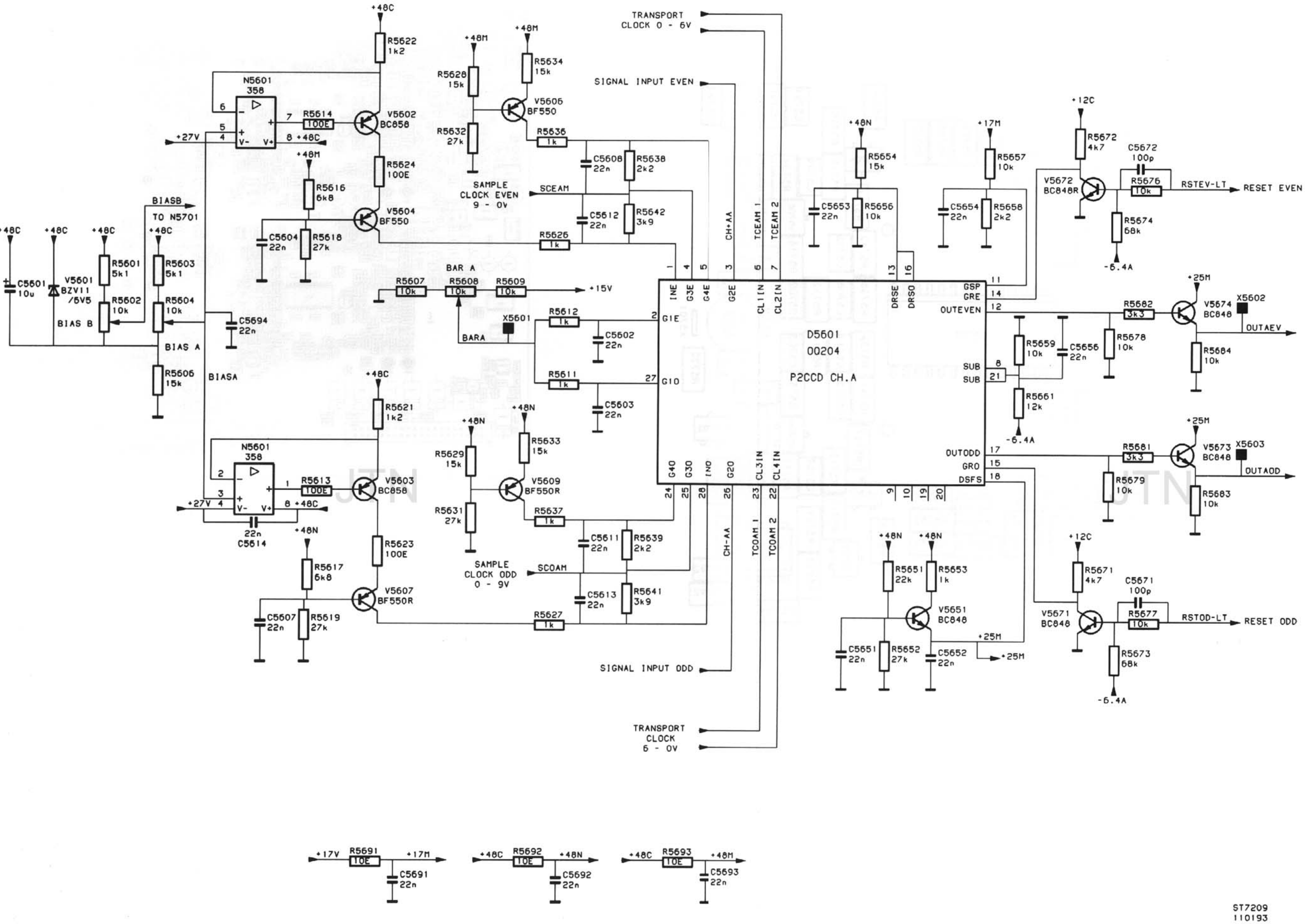


Figure 19.18 Circuit diagram of P²CCD, P²CCD channel A

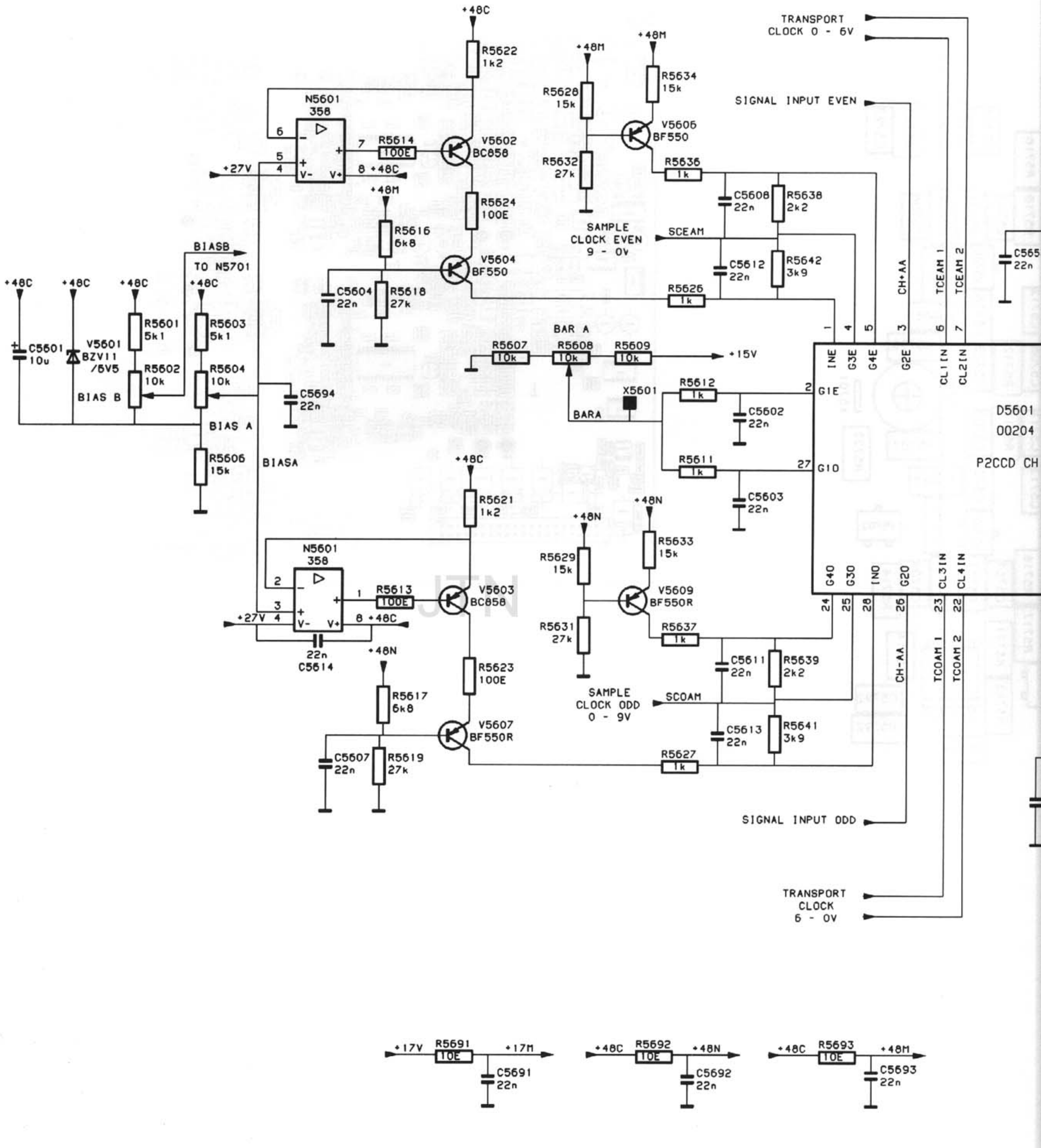
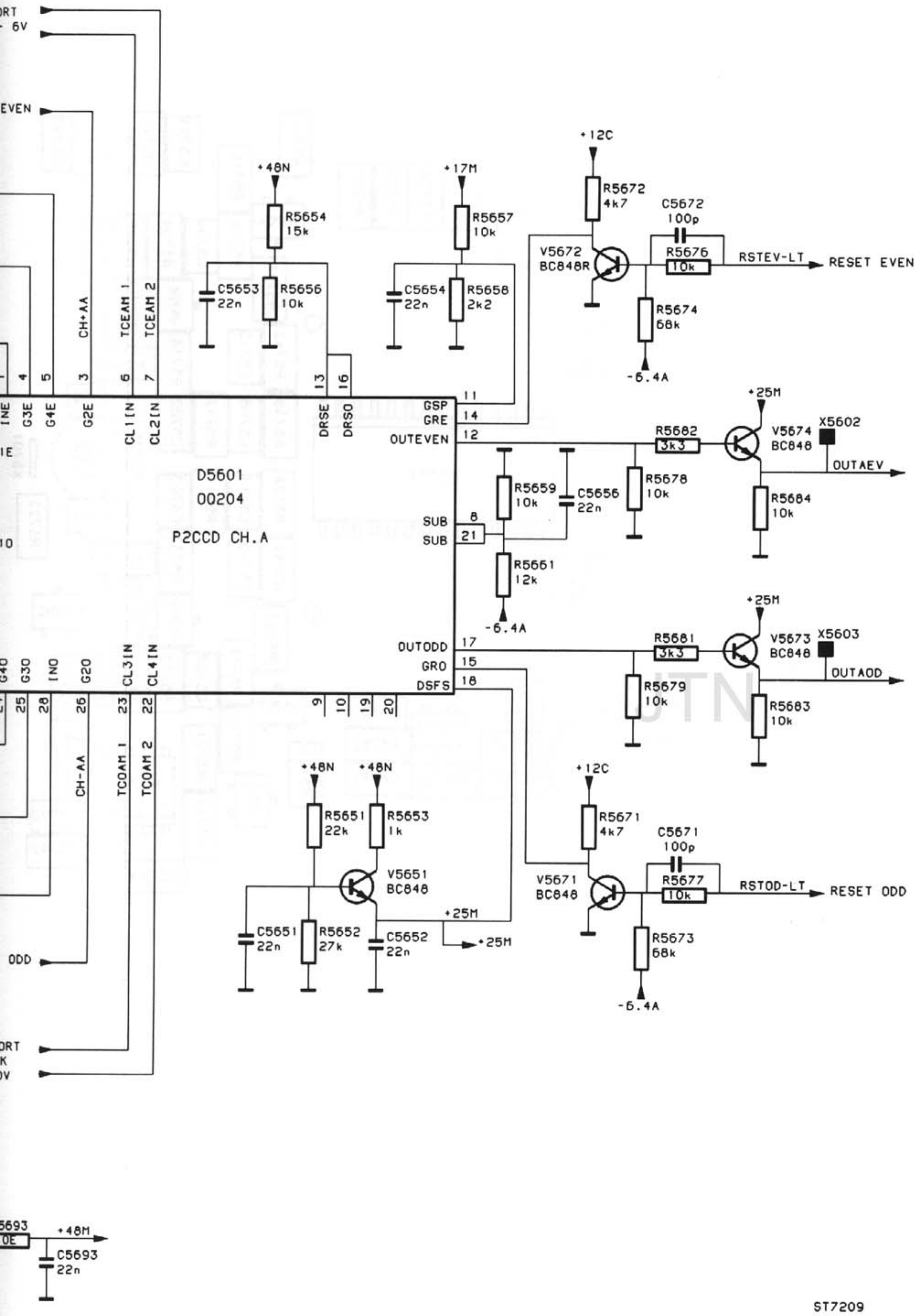
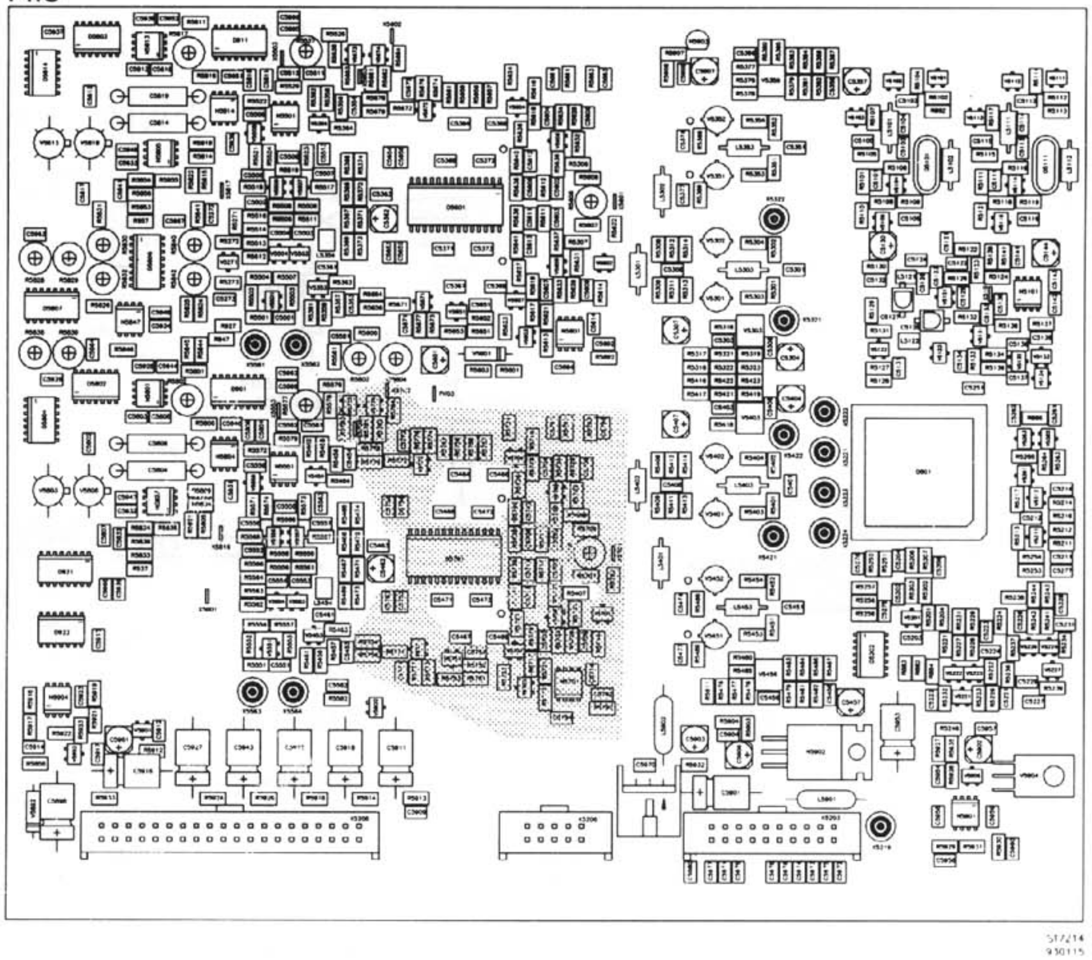


Figure 19.18 Circuit diagram of P^2CCD, P^2CCD channel A



ST7209
110193

A18



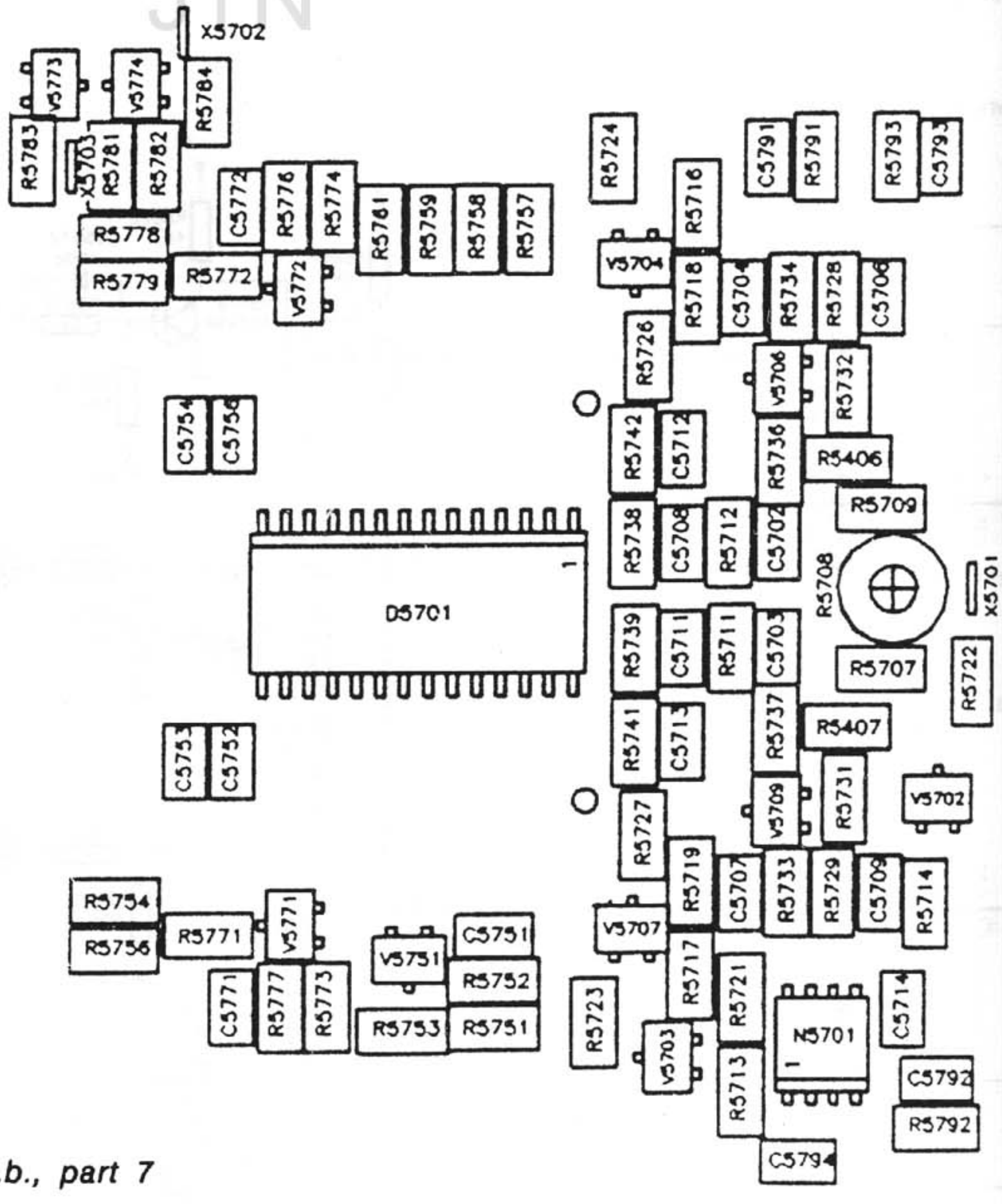


Figure 19.19 Part of P²CCD unit p.c.b., part 7

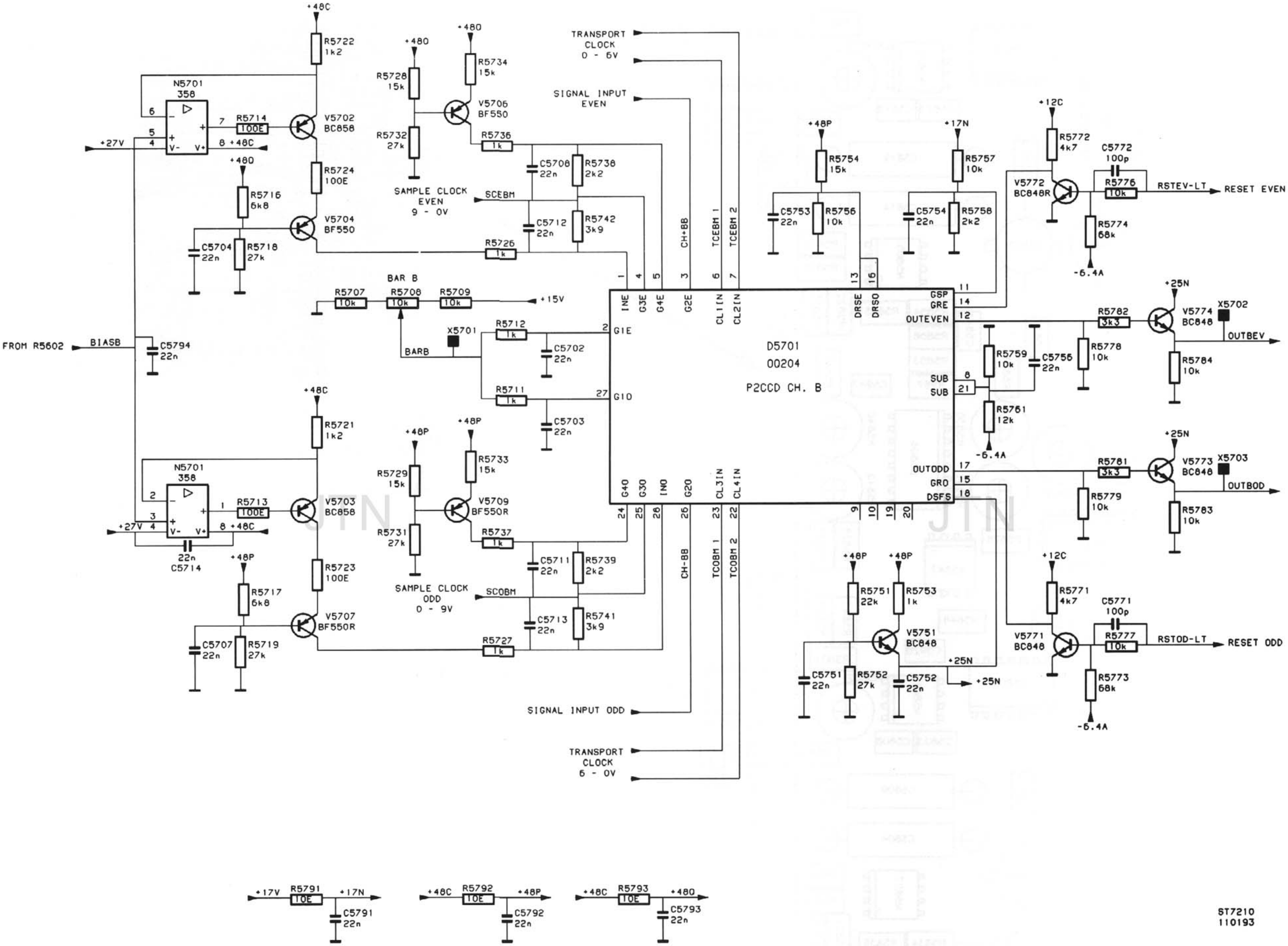


Figure 19.20 Circuit diagram of P²CCD, P²CCD channel B

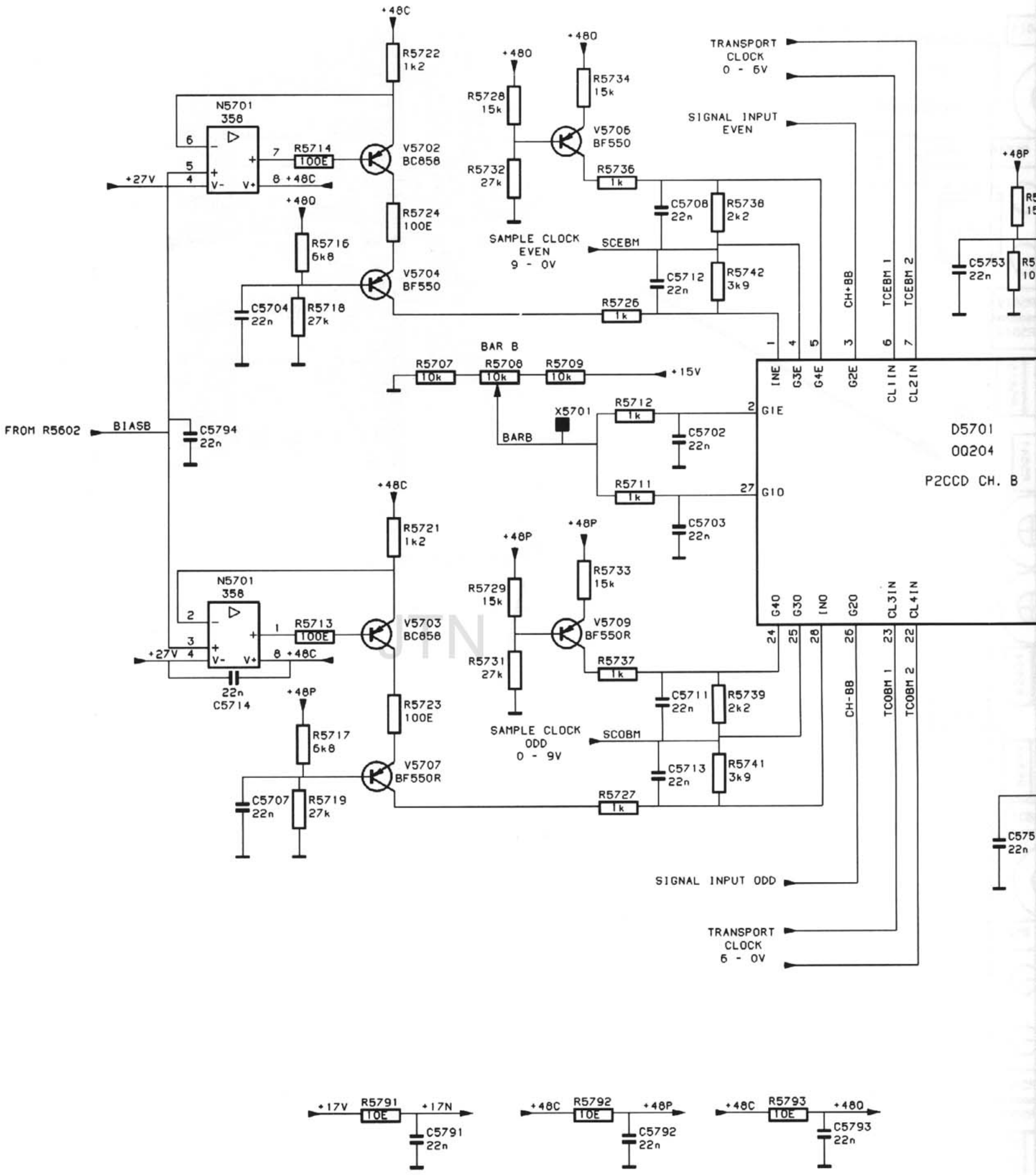
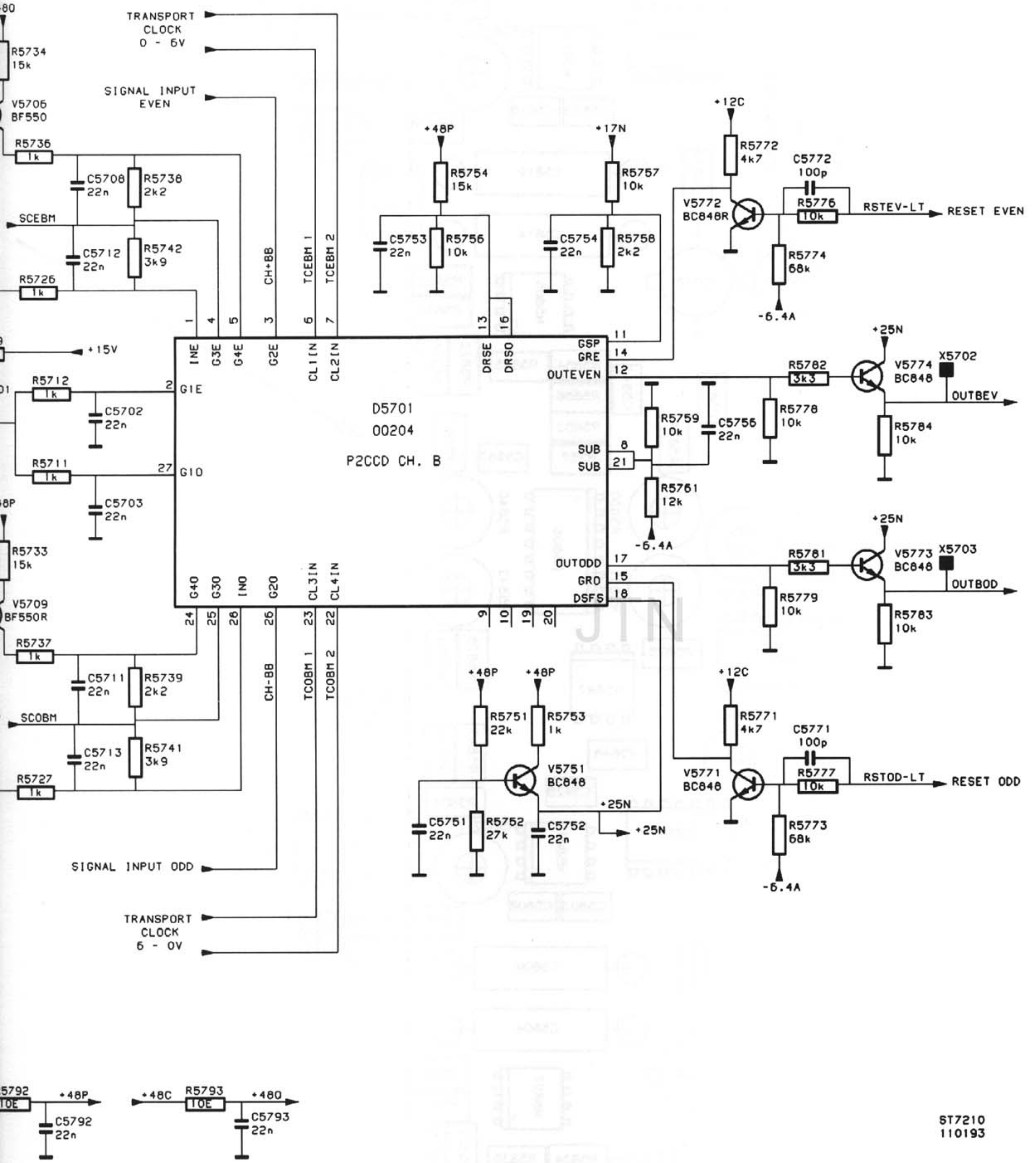


Figure 19.20 Circuit diagram of P^2CCD, P^2CCD channel B


TRANSPORT CLOCK 0 - 6V
SIGNAL INPUT EVEN
SIGNAL INPUT ODD
TRANSPORT CLOCK 6 - 0V
D5701
00204
P2CCD CH. B
RESET EVEN
RESET ODD
RSTEV-LT
RSTOD-LT
OUTBEV
OUTBOD
R5734 15k
V5706 BF550
V5709 BF550R
R5733 15k
SCEBM
SCOBM
R5754 15k
R5757 10k
R5772 4k7
C5772 100p
V5772 BC848R
R5776 10k
R5774 68k
R5782 3k3
V5774 BC848
X5702
R5778 10k
R5784 10k
R5759 10k
C5756 22n
R5761 12k
R5781 3k3
V5773 BC848
X5703
R5779 10k
R5783 10k
R5771 4k7
C5771 100p
V5771 BC848
R5777 10k
R5773 68k
R5751 22k
R5753 1k
V5751 BC848
C5751 22n
R5752 27k
C5752 22n
R5792 10E
C5792 22n
R5793 10E
C5793 22n
ST7210
110193

B

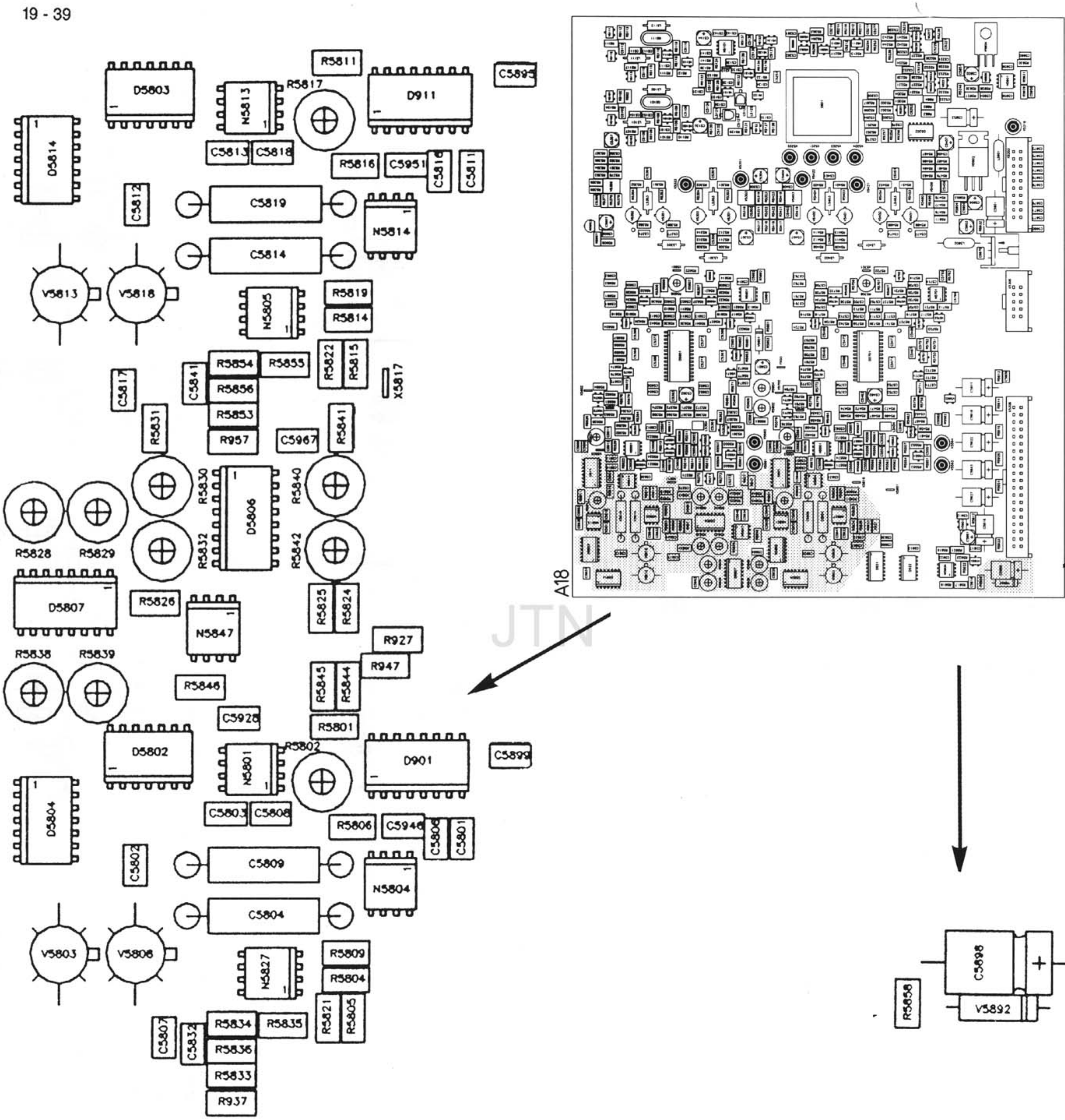
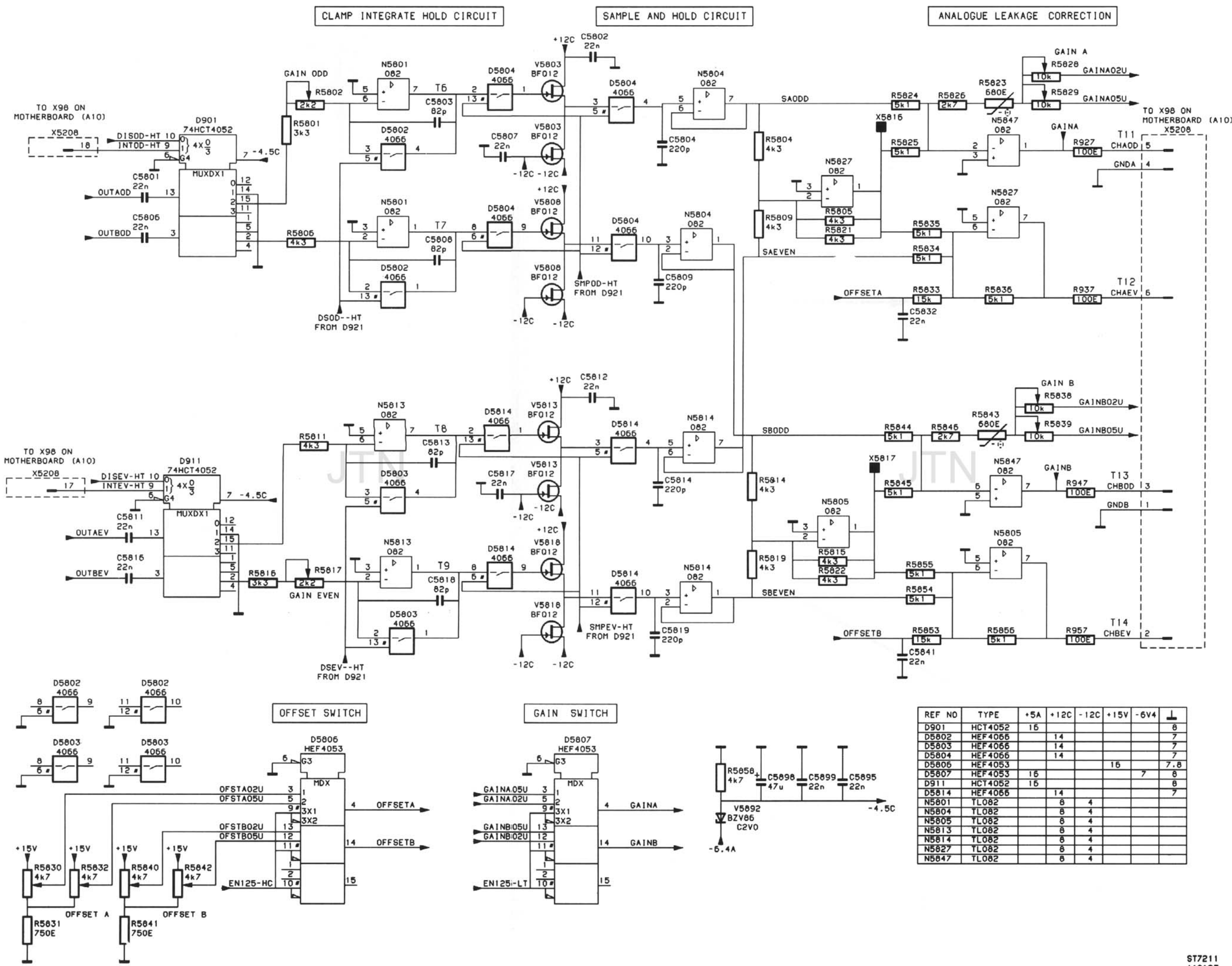


Figure 19.21 Part of P^2CCD unit p.c.b., part 8



REF NO	TYPE	+5A	+12C	-12C	+15V	-6V4	⊥
D901	HCT4052	16					8
D5802	HEF4066		14				7
D5803	HEF4066		14				7
D5804	HEF4066		14				7
D5806	HEF4053				16		7.8
D5807	HEF4053	16				7	8
D911	HCT4052	16					8
D5814	HEF4066		14				7
N5801	TL082		8	4			
N5804	TL082		8	4			
N5805	TL082		8	4			
N5813	TL082		8	4			
N5814	TL082		8	4			
N5827	TL082		8	4			
N5847	TL082		8	4			

Figure 19.22 Circuit diagram of P^2CCD, CIH circuit

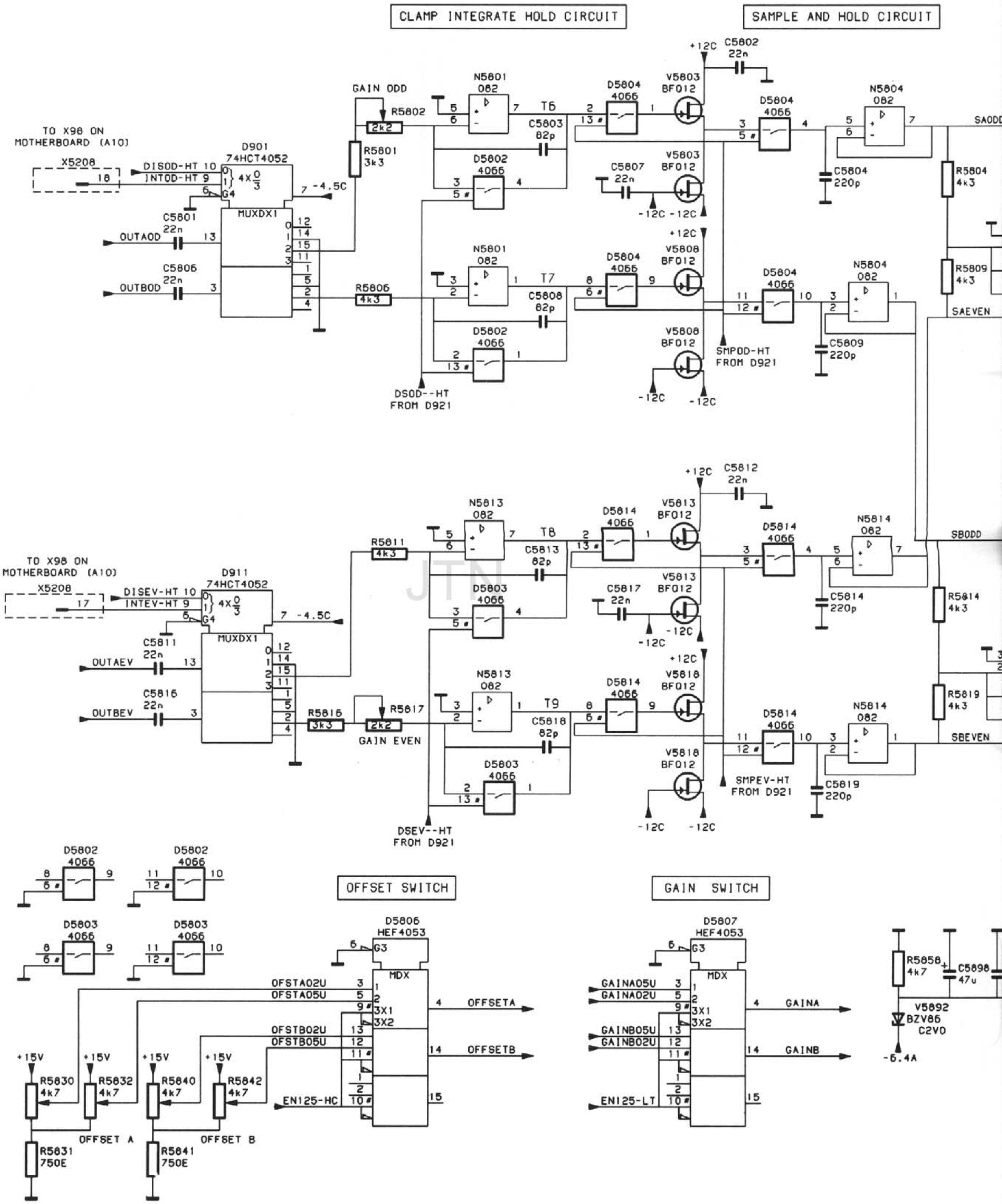
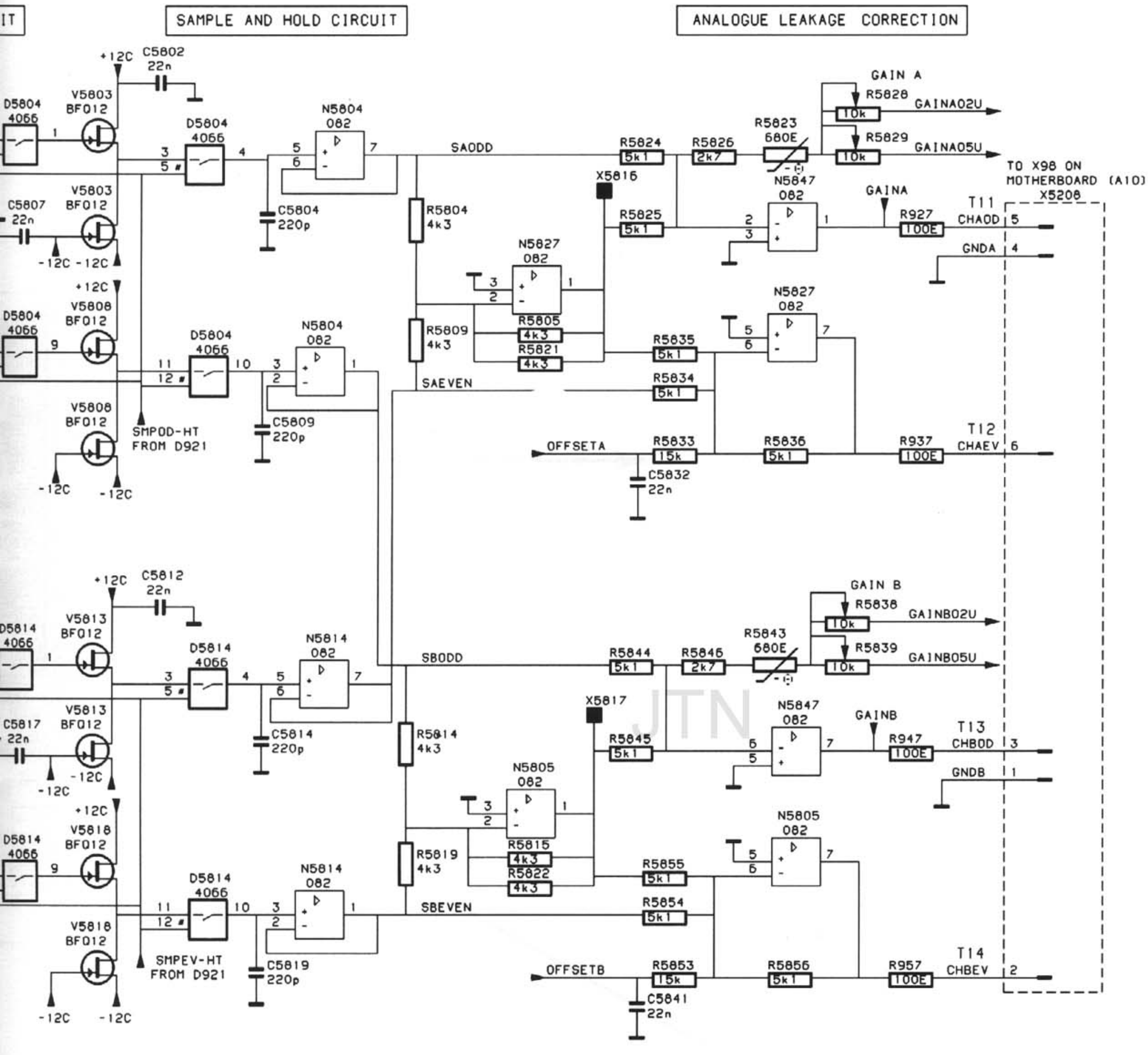
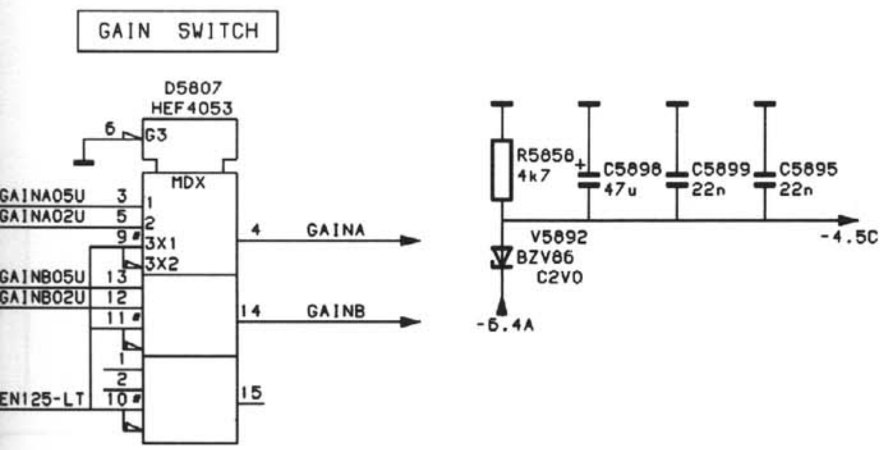


Figure 19.22 Circuit diagram of P^2CCD, CIH circuit





REF NO	TYPE	+5A	+12C	-12C	+15V	-6V4	⊥
D901	HCT4052	16					8
D5802	HEF4066		14				7
D5803	HEF4066		14				7
D5804	HEF4066		14				7
D5806	HEF4053				16		7,8
D5807	HEF4053	16				7	8
D911	HCT4052	16					8
D5814	HEF4066		14				7
N5801	TL082		8	4			
N5804	TL082		8	4			
N5805	TL082		8	4			
N5813	TL082		8	4			
N5814	TL082		8	4			
N5827	TL082		8	4			
N5847	TL082		8	4			

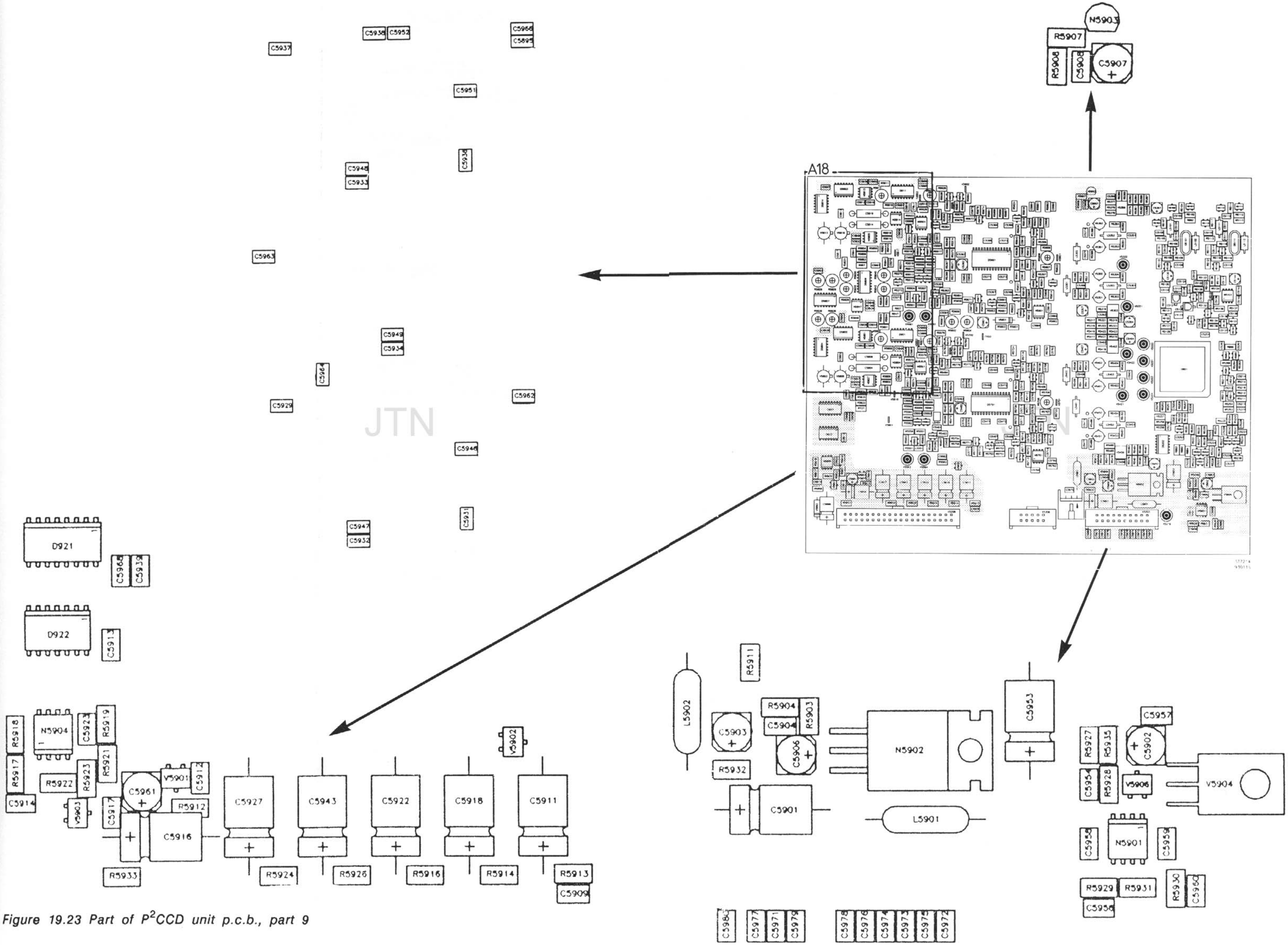


Figure 19.23 Part of P^2CCD unit p.c.b., part 9

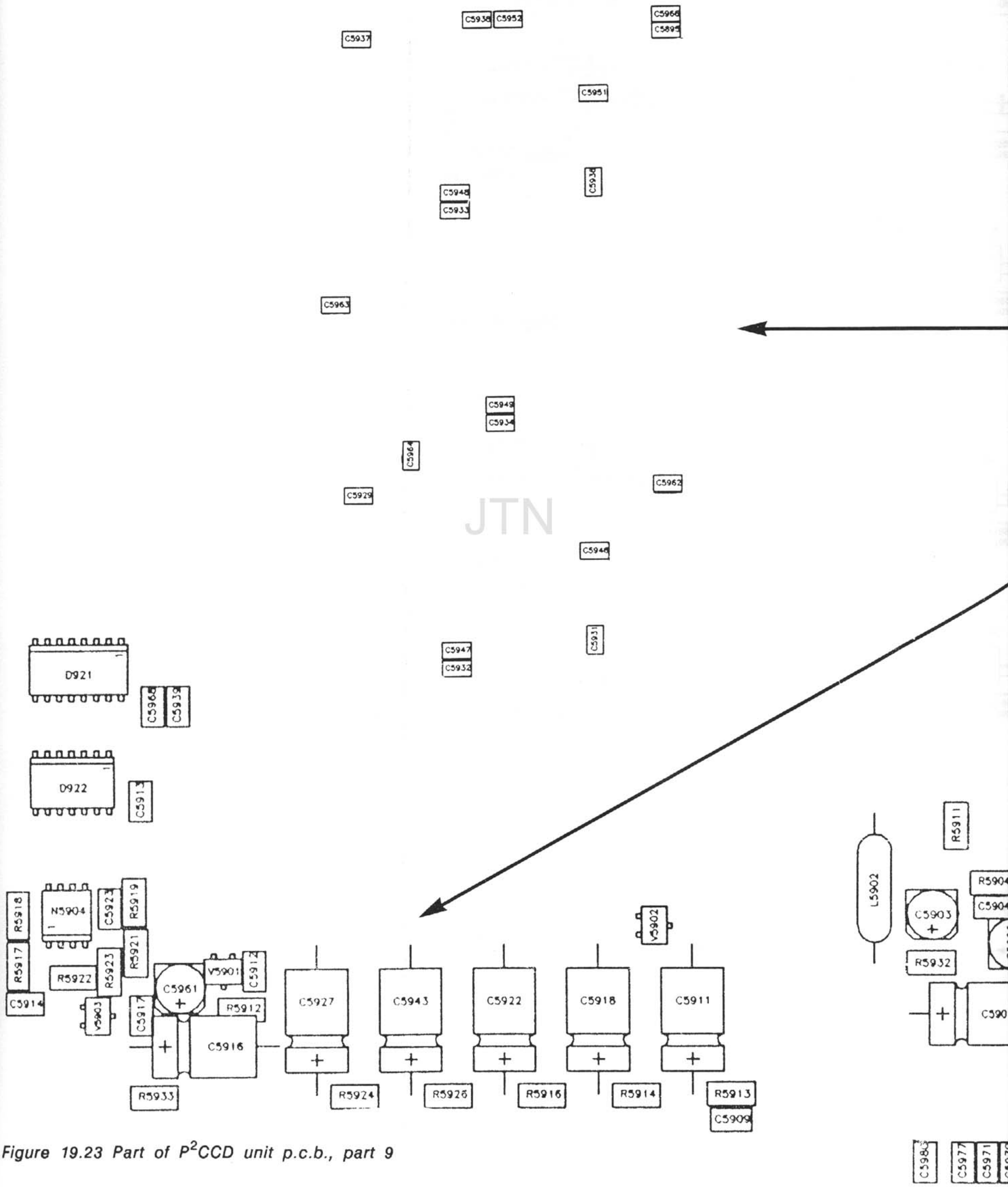
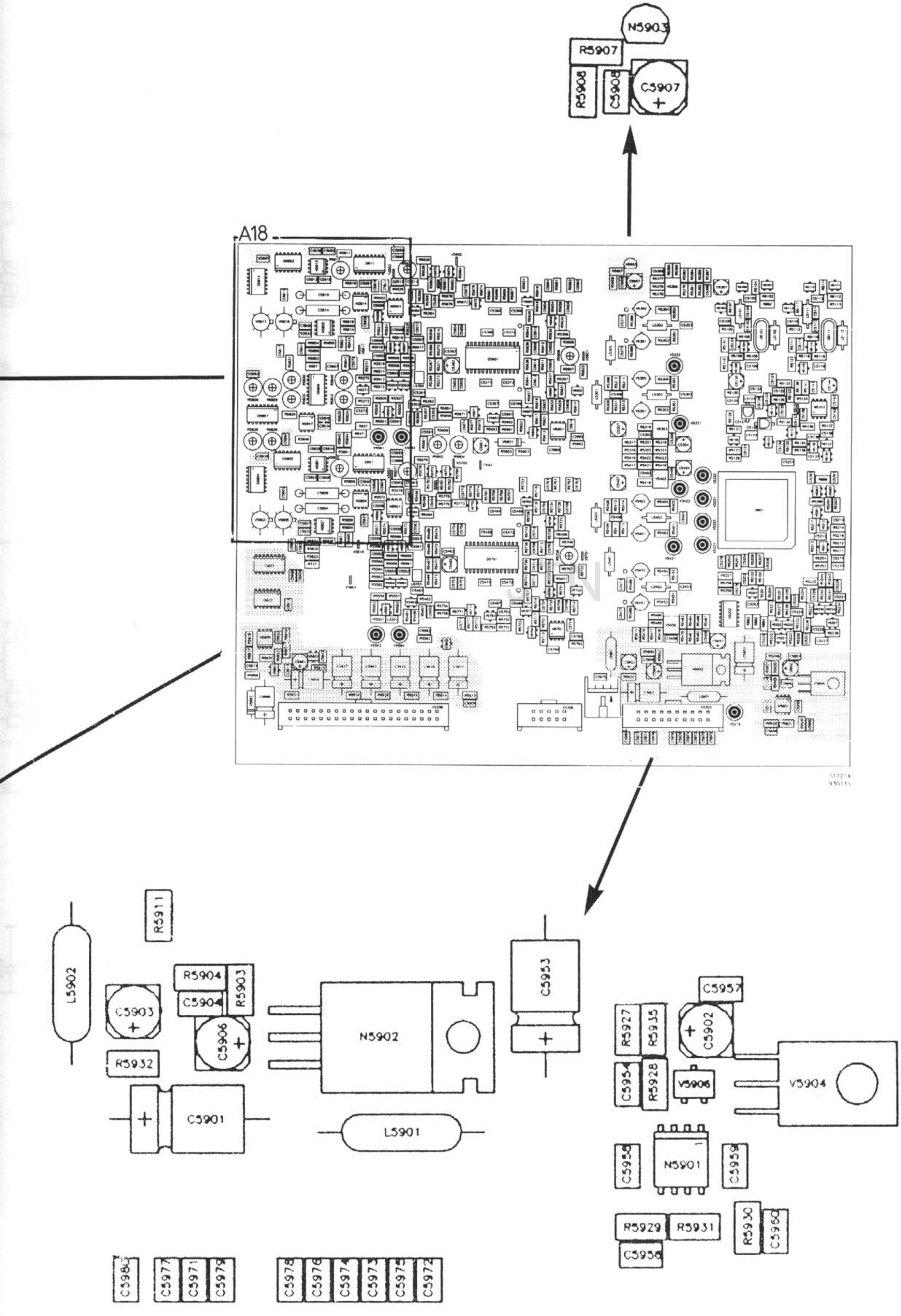
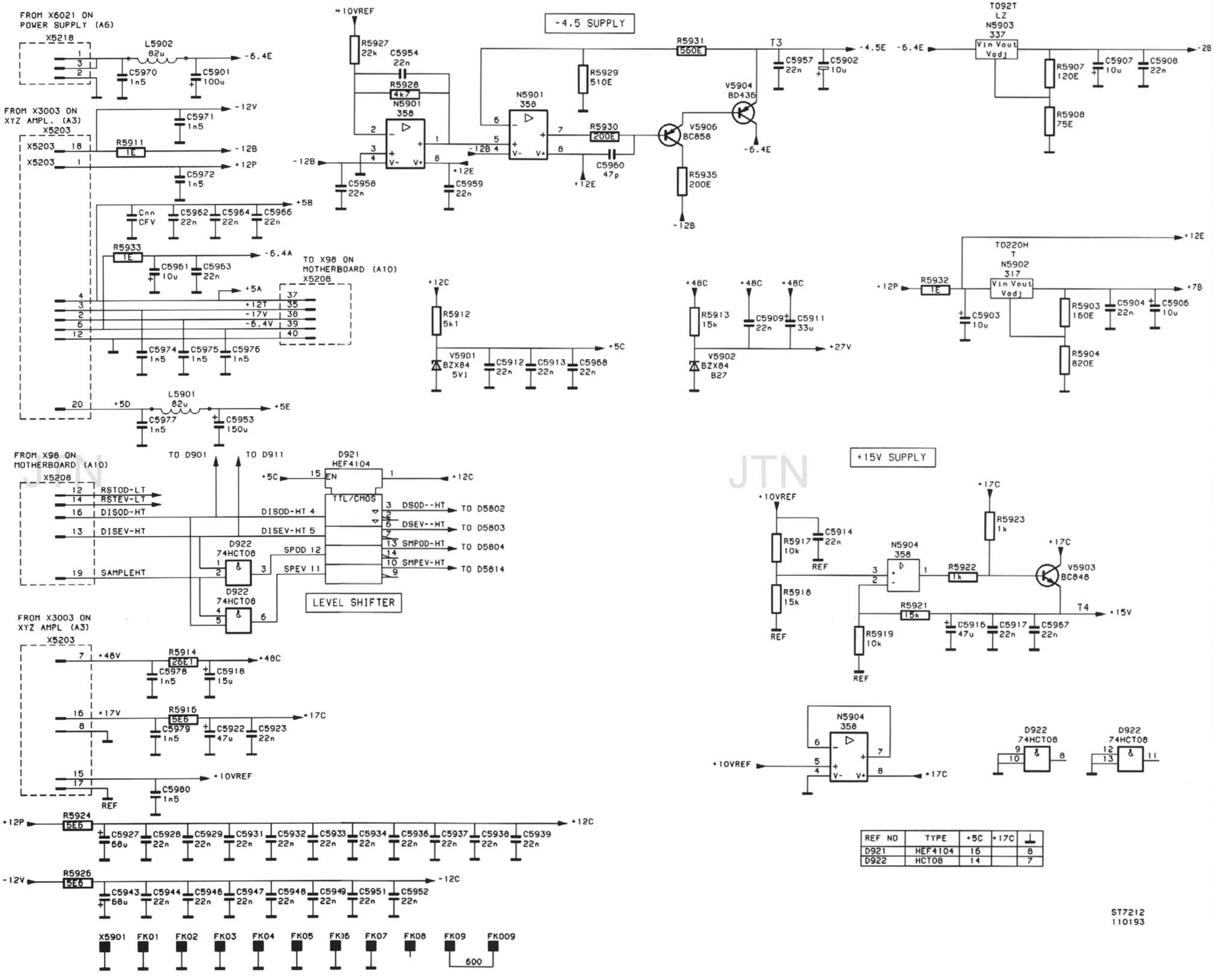


Figure 19.23 Part of P^2CCD unit p.c.b., part 9



A18
N5903
R5907
R5908
C5908
C5907
R5911
L5902
R5904
R5903
C5904
C5903
C5906
R5932
N5902
C5953
C5901
L5901
C5957
R5927
R5935
C5902
C5954
R5928
V5906
V5904
C5958
N5901
C5959
R5929
R5931
R5930
C5960
C5956
C5977
C5971
C5979
C5978
C5976
C5974
C5973
C5975
C5972



REF NO	TYPE	+5C	+17C	⊥
D921	HEF4104	16		8
D922	HCT08	14		7

Figure 19.24 Circuit diagram of P²CCD, power supplies and level shifter

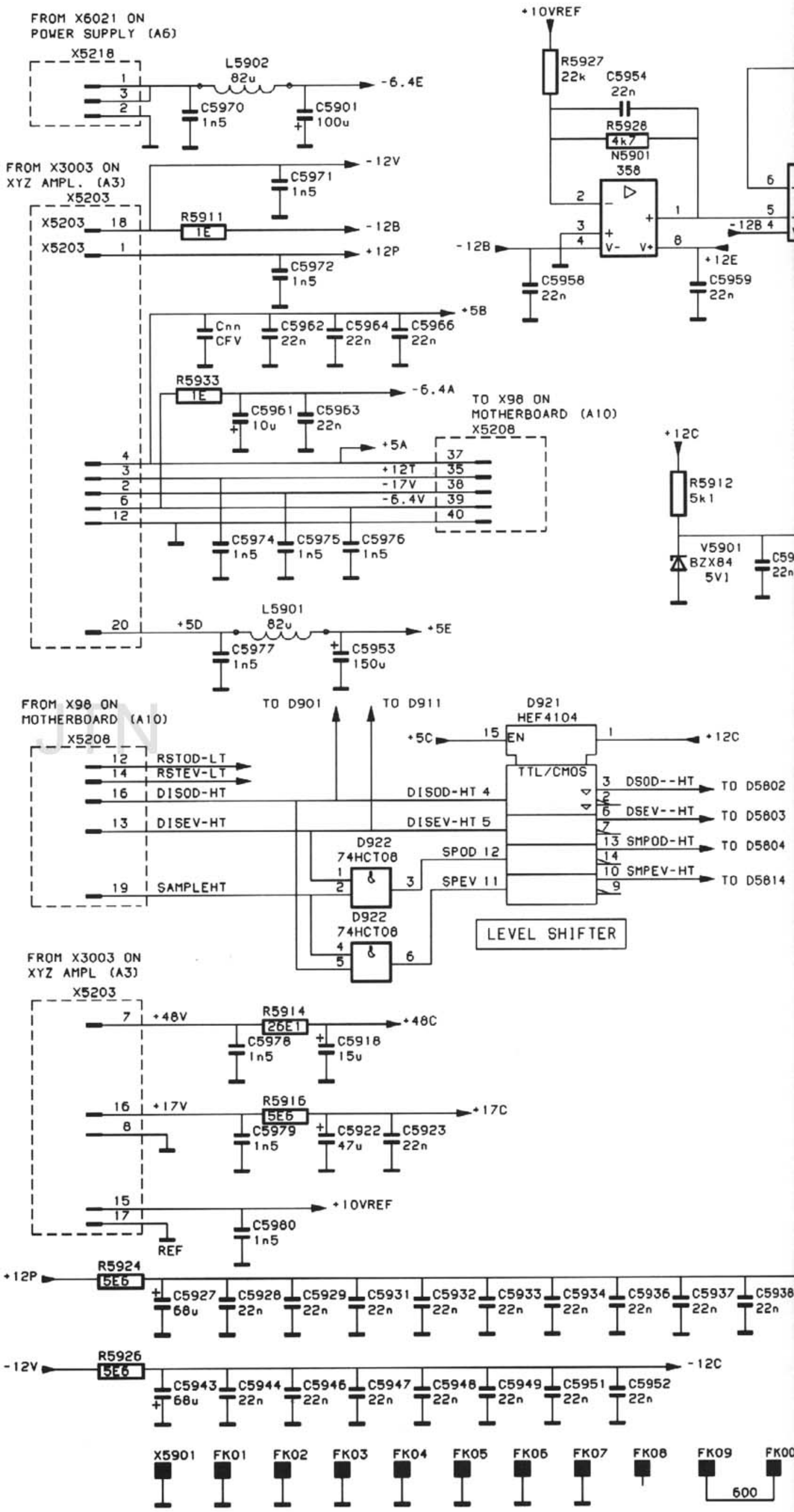
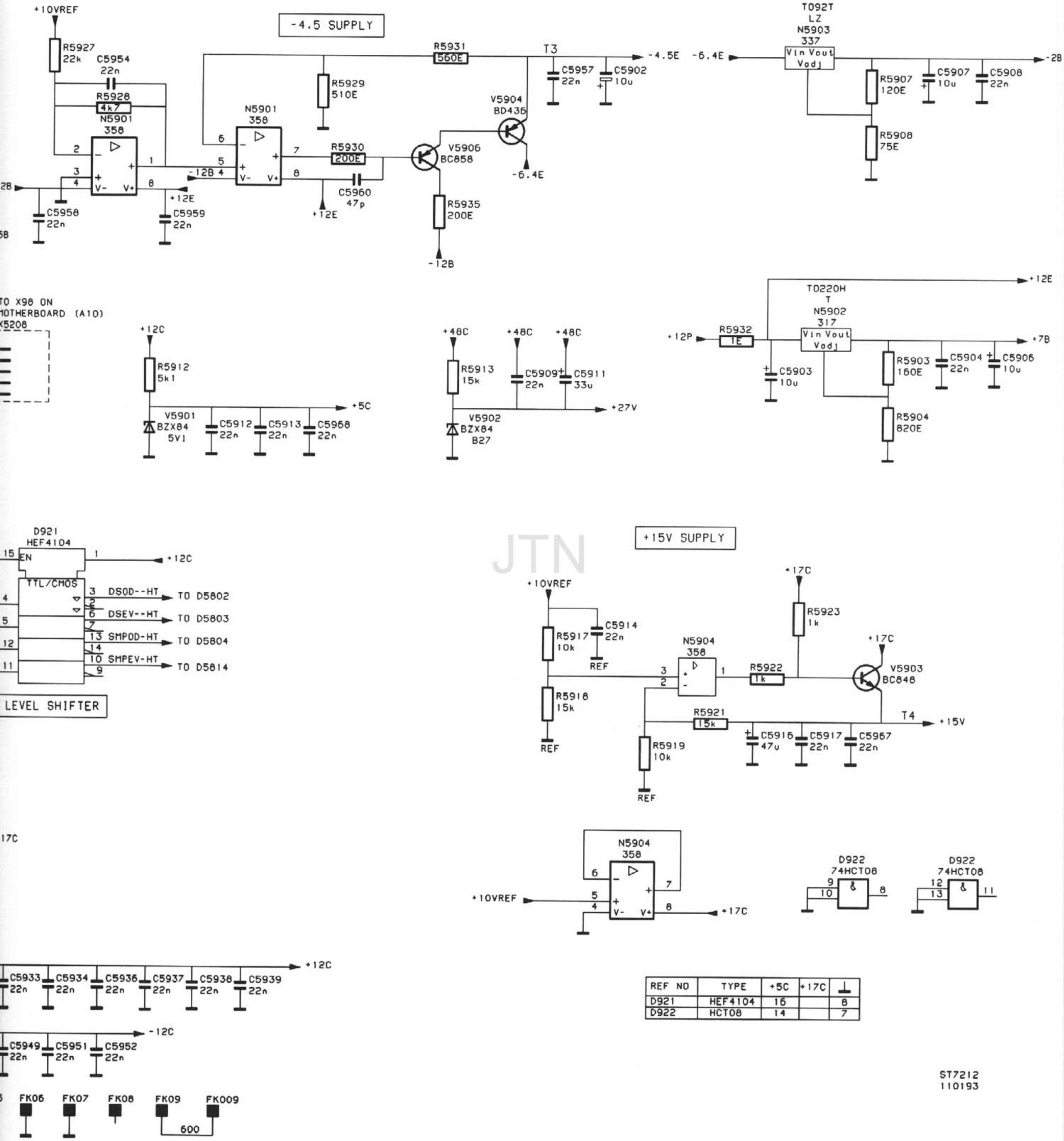


Figure 19.24 Circuit diagram of P^2CCD, power supplies and level shifter



REF NO	TYPE	+5C	+17C	⊥
D921	HEF4104	16		8
D922	HCT08	14		7

ST7212
110193

TEST PIN	SIGNAL	ADJUSTING ELEMENT
X5101	RES. INDICATION	C5127/28
X5503	DC LEVEL A	R5527
X5553	DC LEVEL B	R5577
X5601	BAR A	R5608
X5701	BAR B	R5708
X5602	OUTAEV	R5604
X5603	OUTAOD	R5604
X5702	OUTBEV	R5602
X5703	OUTBOD	R5602
X5816	LEAKAGE A	R5802
X5818	LEAKAGE B	R5817
X5901	GND	

ADJUSTING ELEMENTS:

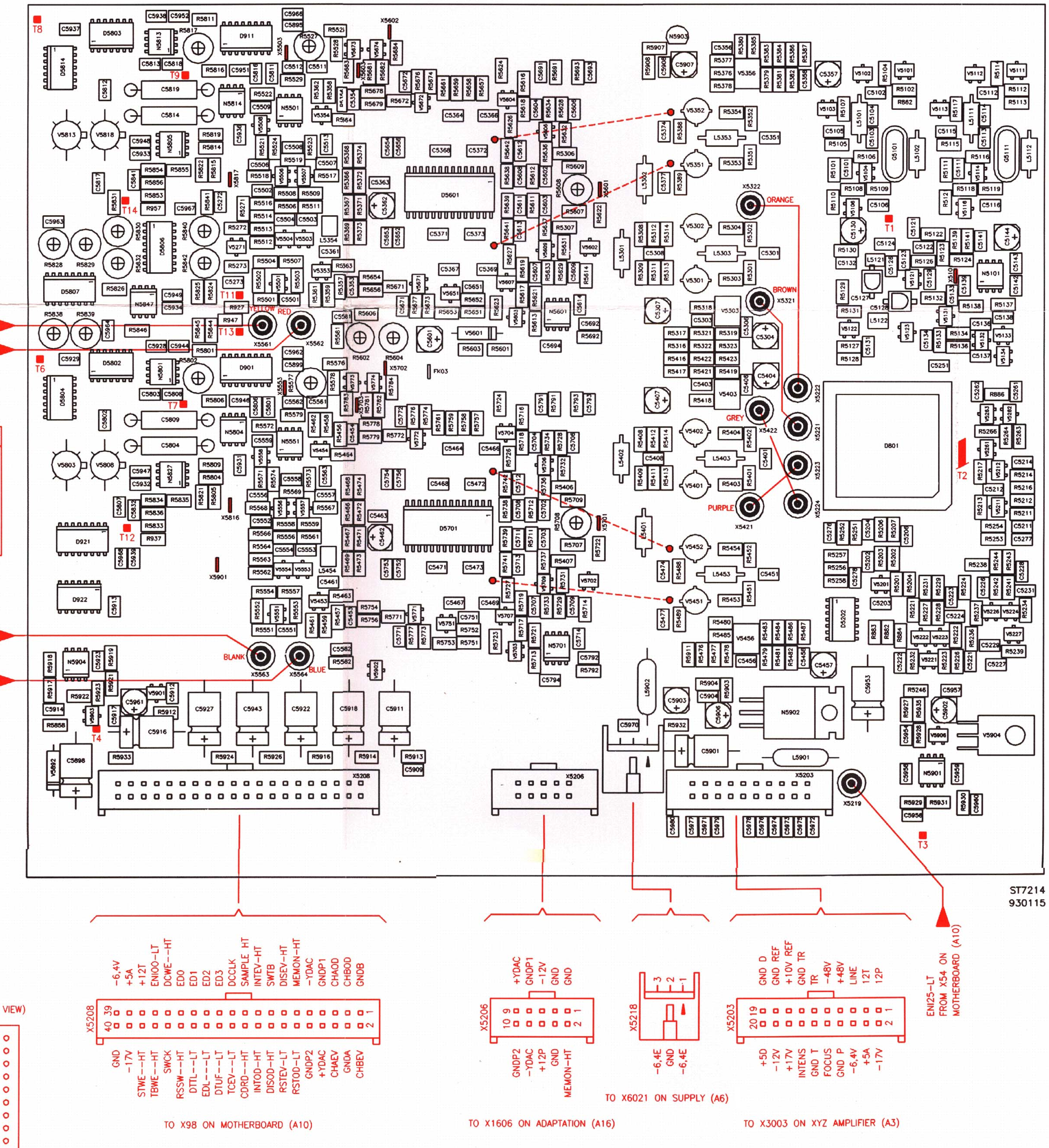
C5127	RESONANCE 250 MHz
C5128	RESONANCE 200 MHz
R5527	DC LEVEL A
R5577	DC LEVEL B
R5604	BIAS A
R5602	BIAS B
R5608	BAR A
R5708	BAR B
R5817	GAIN EVEN
R5802	GAIN ODD
R5828	GAIN A 200 NS
R5829	GAIN A
R5838	GAIN B 200 NS
R5839	GAIN B
R5830	OFFSET A 200 NS
R5832	OFFSET A
R5840	OFFSET B 200 NS
R5842	OFFSET B

TESTPADS:

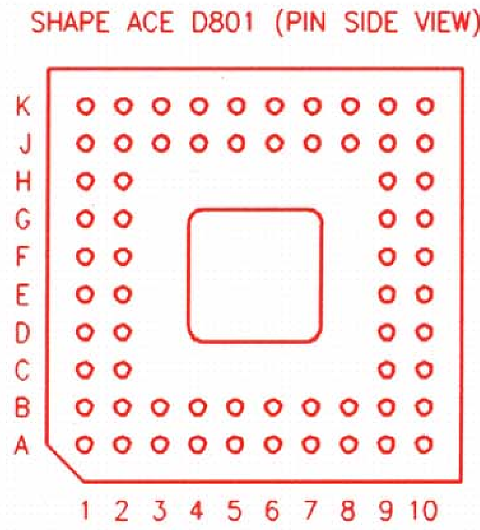
T1	100 MHz OR 125 MHz
T2	CLOCK OUT CK200250 (1 Vp-p SINE-WAVE)
T3	-4,5V
T4	+15V
T6, T7, T8, T9	Ux
T11	CHAOD OUTPUT
T12	CHAEV OUTPUT
T13	CHBOD OUTPUT
T14	CHBEV OUTPUT

50 Ω CABLE CONNECTIONS

X5561	FROM X 661	(PM3355)
	FROM X1661	(PM3375)
X5562	FROM X 662	(PM3355)
	FROM X1662	(PM3375)
X5563	FROM X 663	(PM3355)
	FROM X1663	(PM3375)
X5564	FROM X 664	(PM3355)
	FROM X1664	(PM3375)



SHAPE ACE D801 (PIN SIDE VIEW)



SHAPES (TOP VIEW)

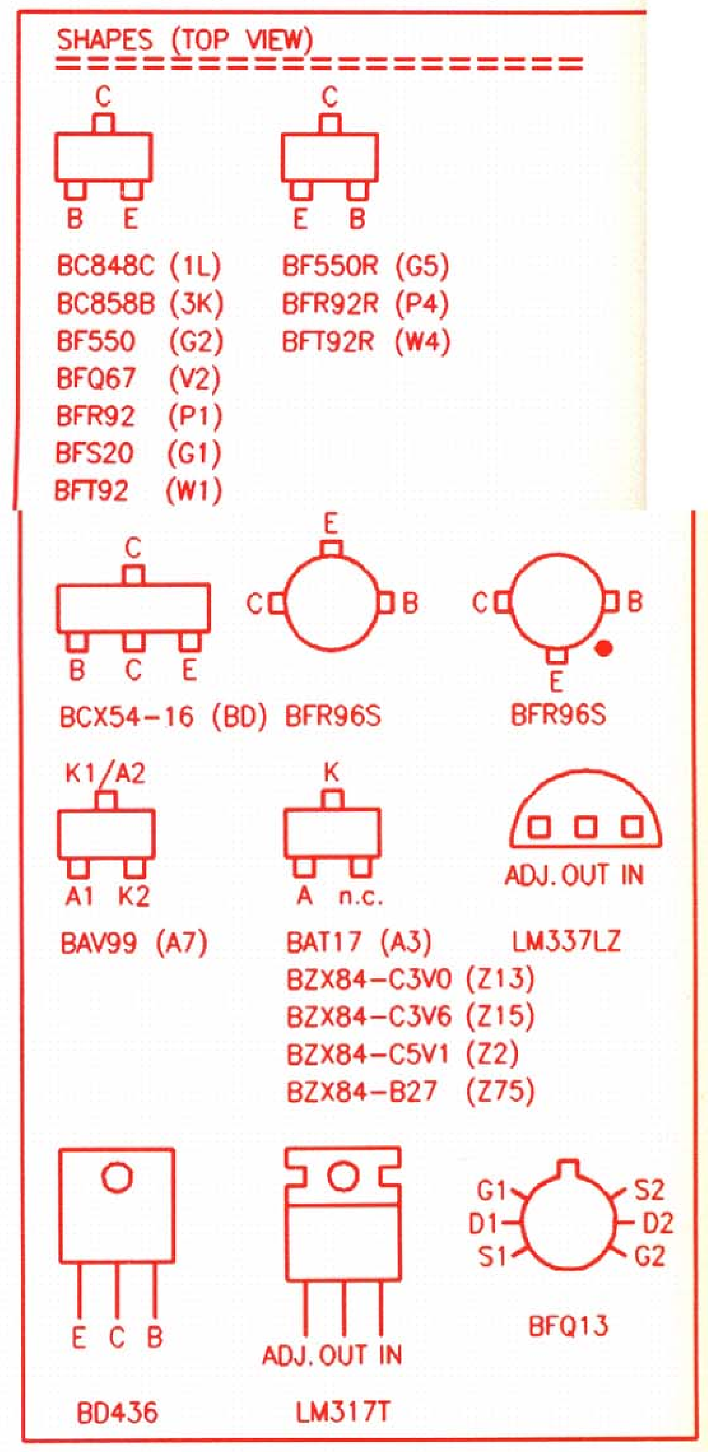
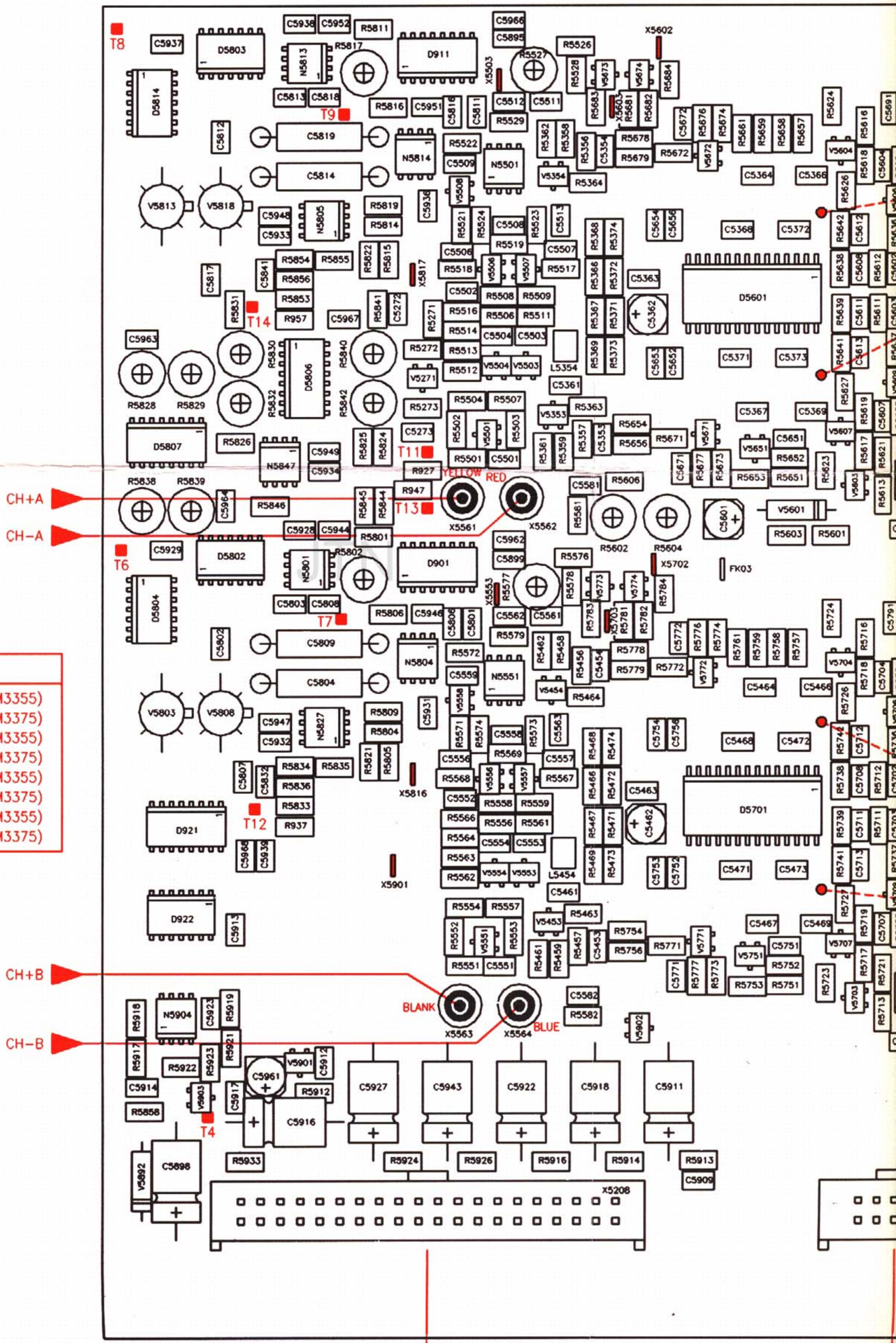
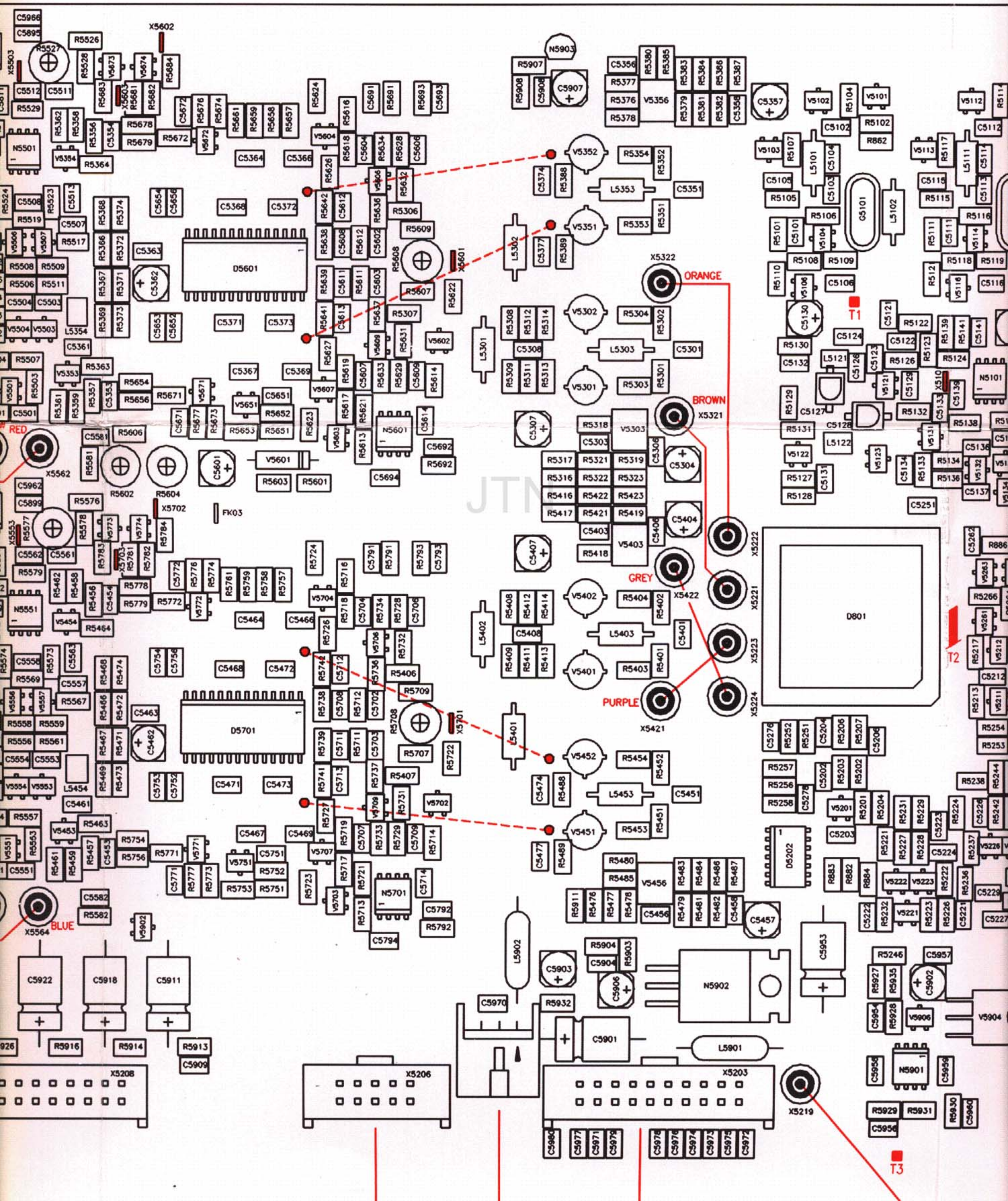


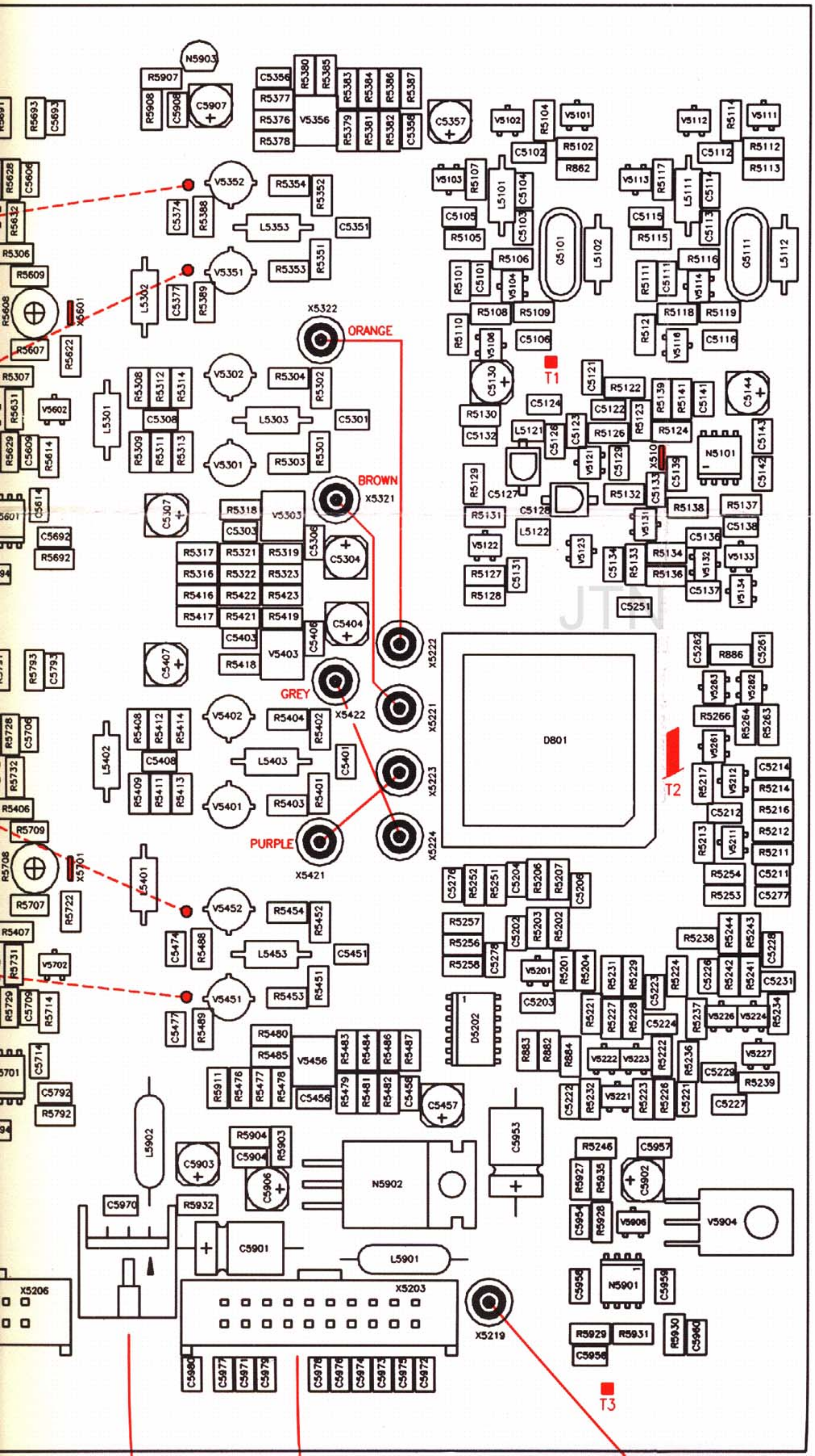
Figure 19.25 P²CCD unit



50 Ω CABLE CONNECTIONS		
X5561	FROM X 661	(PM3355)
	FROM X1661	(PM3375)
X5562	FROM X 662	(PM3355)
	FROM X1662	(PM3375)
X5563	FROM X 663	(PM3355)
	FROM X1663	(PM3375)
X5564	FROM X 664	(PM3355)
	FROM X1664	(PM3375)



ORANGE
BROWN
GREY
PURPLE
RED
BLUE
T1
T2
T3
X5322
X5321
X5422
X5421
X5222
X5221
X5223
X5224
X5562
X5564
X5219
X5208
X5206
X5203
D5601
D5701
D801
N5902



TEST PIN	SIGNAL	ADJUSTING ELEMENT
X5101	RES. INDICATION	C5127/28
X5503	DC LEVEL A	R5527
X5553	DC LEVEL B	R5577
X5601	BAR A	R5608
X5701	BAR B	R5708
X5602	OUTAEV	R5604
X5603	OUTAOD	R5604
X5702	OUTBEV	R5602
X5703	OUTBOD	R5602
X5816	LEAKAGE A	R5802
X5818	LEAKAGE B	R5817
X5901	GND	

ADJUSTING ELEMENTS:

C5127	RESONANCE 250 MHz
C5128	RESONANCE 200 MHz
R5527	DC LEVEL A
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R5604	BIAS A
R5602	BIAS B
R5608	BAR A
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R5817	GAIN EVEN
R5802	GAIN ODD
R5828	GAIN A 200 NS
R5829	GAIN A
R5838	GAIN B 200 NS
R5839	GAIN B
R5830	OFFSET A 200 NS
R5832	OFFSET A
R5840	OFFSET B 200 NS
R5842	OFFSET B

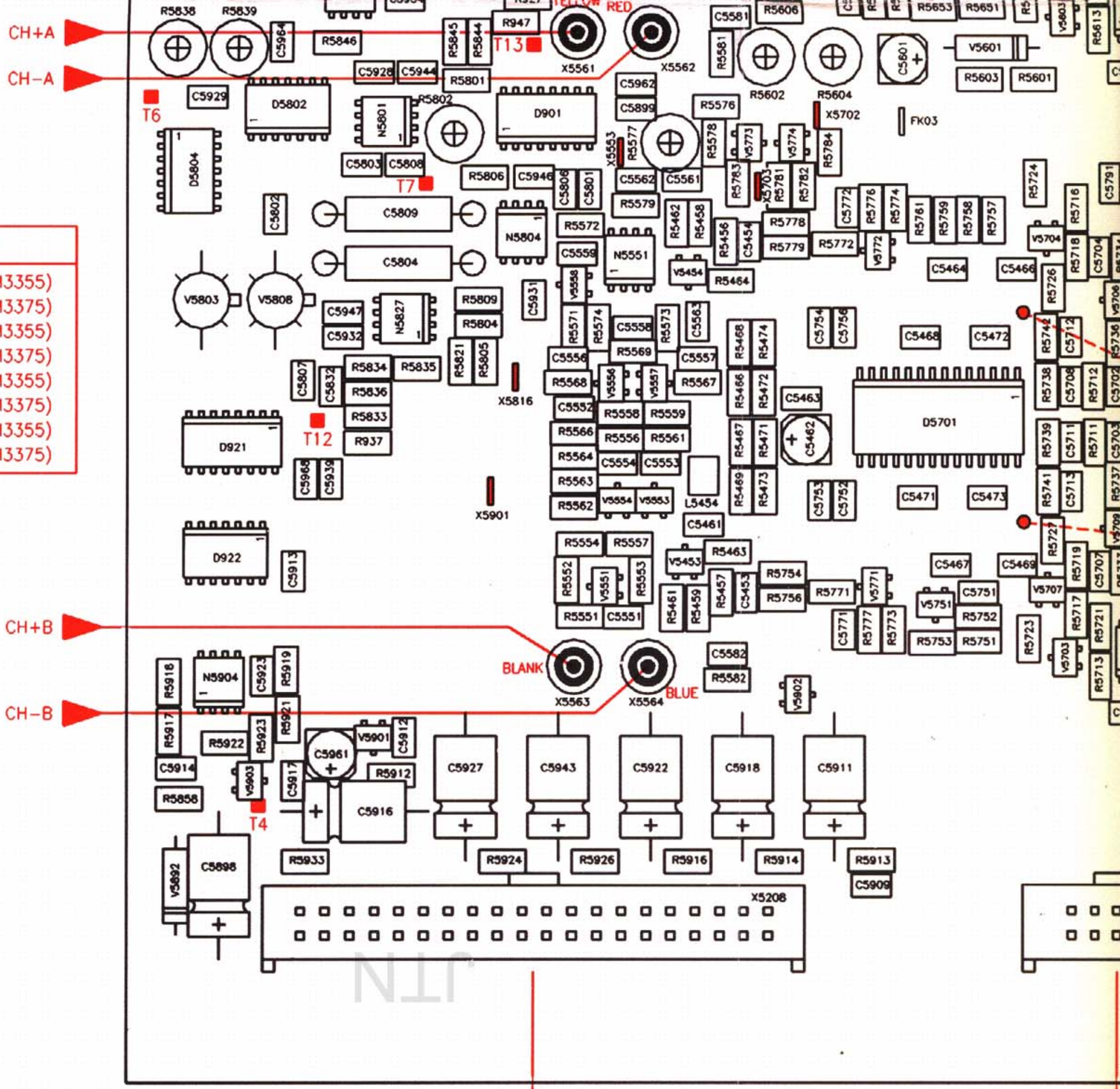
TESTPADS:

T1	100 MHz OR 125 MHz
T2	CLOCK OUT CK200250 (1 Vp-p SINE-WAVE)
T3	−4,5V
T4	+15V
T6	Ux
T7	Ux
T8	Ux
T9	Ux
T11	CHAOD OUTPUT
T12	CHAEV OUTPUT
T13	CHBOD OUTPUT
T14	CHBEV OUTPUT

SHAPES (TOP VIEW)

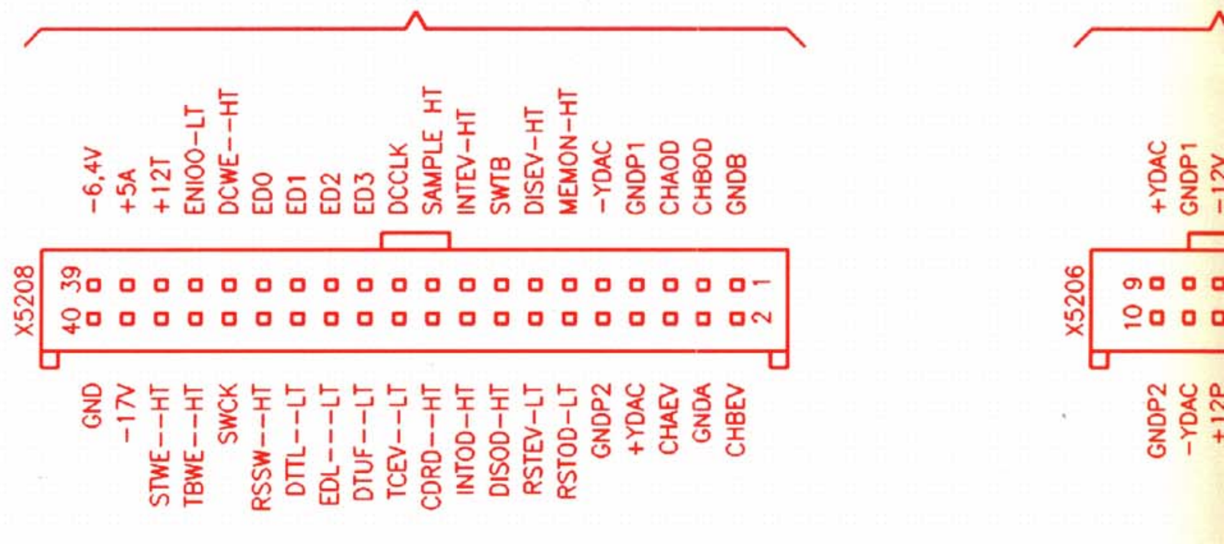
BC848C (1L)	BF550R (G5)
BC858B (3K)	BFR92R (P4)
BF550 (G2)	BFT92R (W4)
BFQ67 (V2)	
BFR92 (P1)	
BFS20 (G1)	
BFT92 (W1)	

E



50 Ω CABLE CONNECTIONS

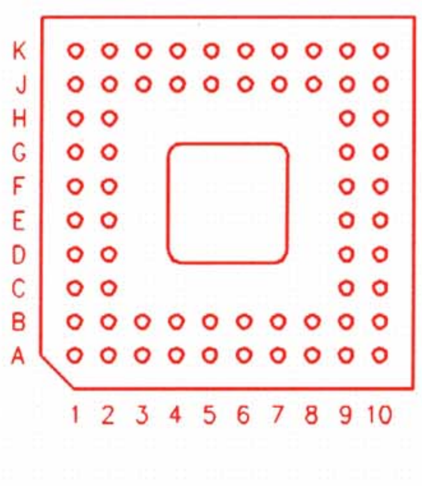
X5561	FROM	X 661	(PM3355)
	FROM	X1661	(PM3375)
X5562	FROM	X 662	(PM3355)
	FROM	X1662	(PM3375)
X5563	FROM	X 663	(PM3355)
	FROM	X1663	(PM3375)
X5564	FROM	X 664	(PM3355)
	FROM	X1664	(PM3375)

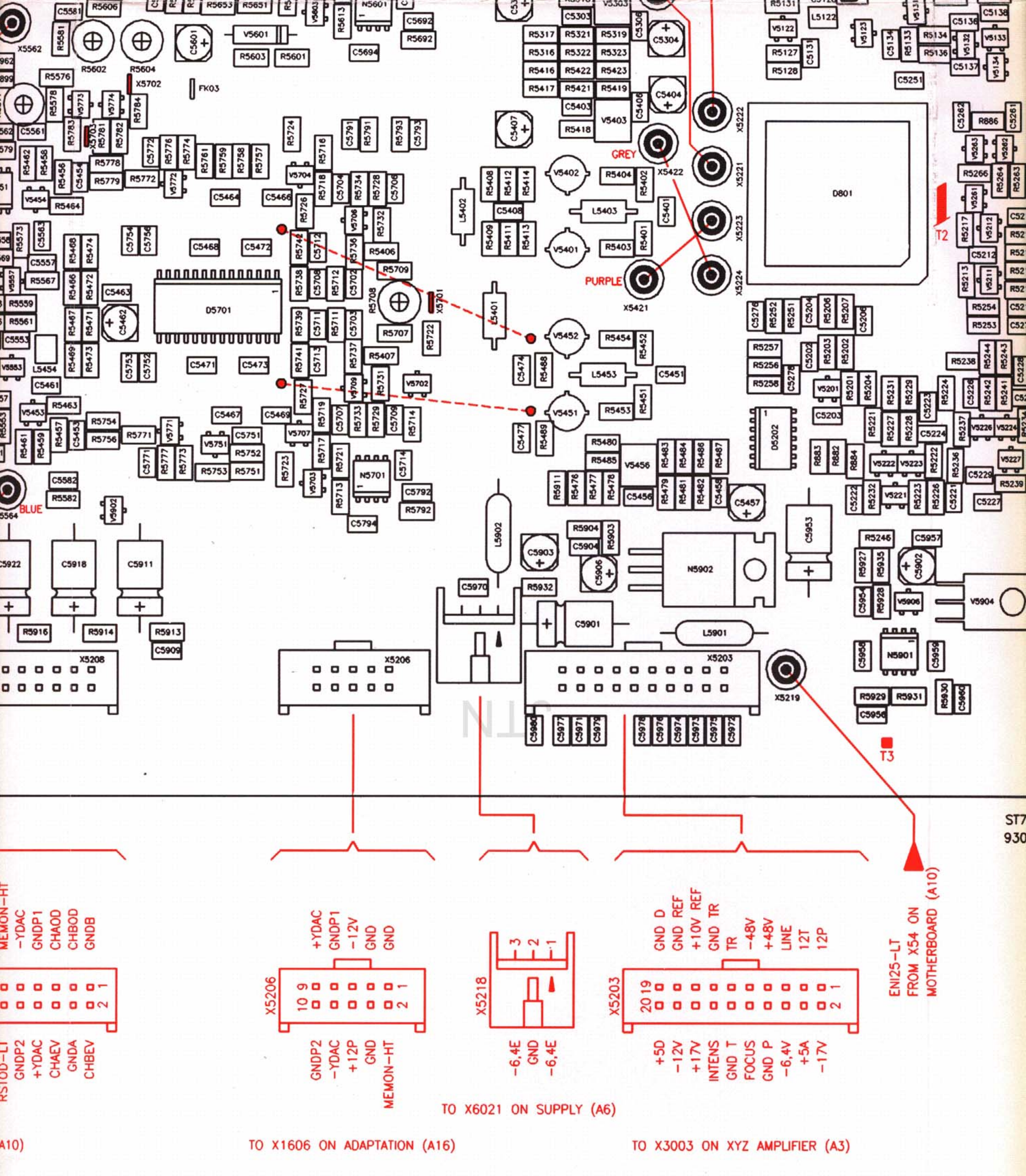


TO X98 ON MOTHERBOARD (A10)

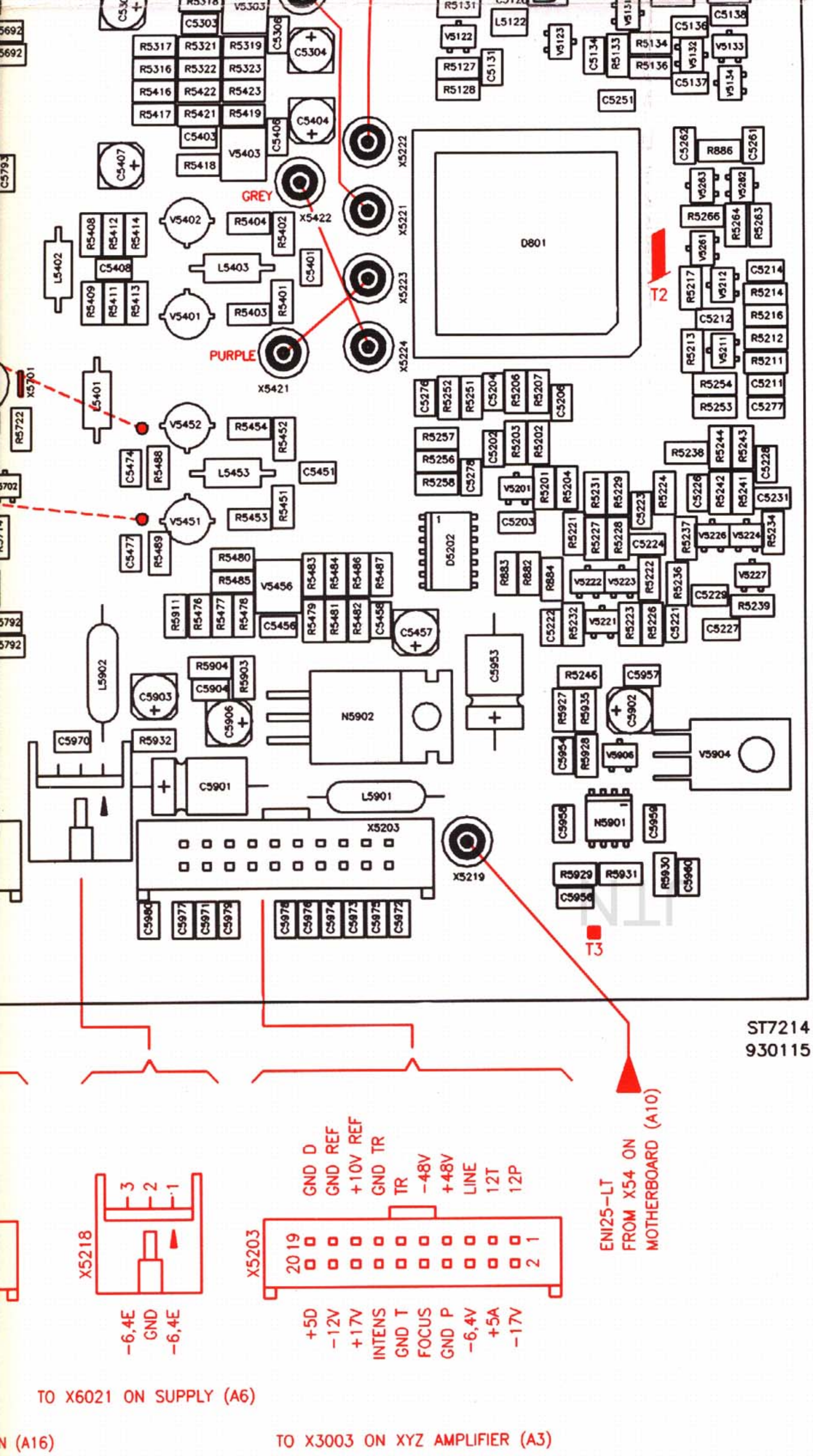
TO X1606 ON AD

SHAPE ACE D801 (PIN SIDE VIEW)





GREY
PURPLE
BLUE
T2
T3
X5206
+YDAC GNDP1 -12V GND GND
GNDP2 -YDAC +12P GND MEMON-HT
X5218
3 2 1
-6,4E GND -6,4E
X5203
GND D GND REF +10V REF GND TR TR -48V +48V LINE 12T 12P
+5D -12V +17V INTENS GND T FOCUS GND P -6,4V +5A -17V
MEMON-HT -YDAC GNDP1 CHAOD CHBOD GNDB
GNDP2 +YDAC CHAEV GNDA CHBEV
ENI25-LT
FROM X54 ON
MOTHERBOARD (A10)
TO X6021 ON SUPPLY (A6)
TO X1606 ON ADAPTATION (A16)
TO X3003 ON XYZ AMPLIFIER (A3)
(A10)
ST7
930



R5708 BAR B

R5817 GAIN EVEN
R5802 GAIN ODD

R5828 GAIN A 200 NS
R5829 GAIN A
R5838 GAIN B 200 NS
R5839 GAIN B
R5830 OFFSET A 200 NS
R5832 OFFSET A
R5840 OFFSET B 200 NS
R5842 OFFSET B

TESTPADS:

T1	100 MHz OR 125 MHz
T2	CLOCK OUT CK200250 (1 Vp-p SINE-WAVE)
T3	-4,5V
T4	+15V
T6, T7, T8, T9	Ux
T11	CHAOD OUTPUT
T12	CHAEV OUTPUT
T13	CHBOD OUTPUT
T14	CHBEV OUTPUT

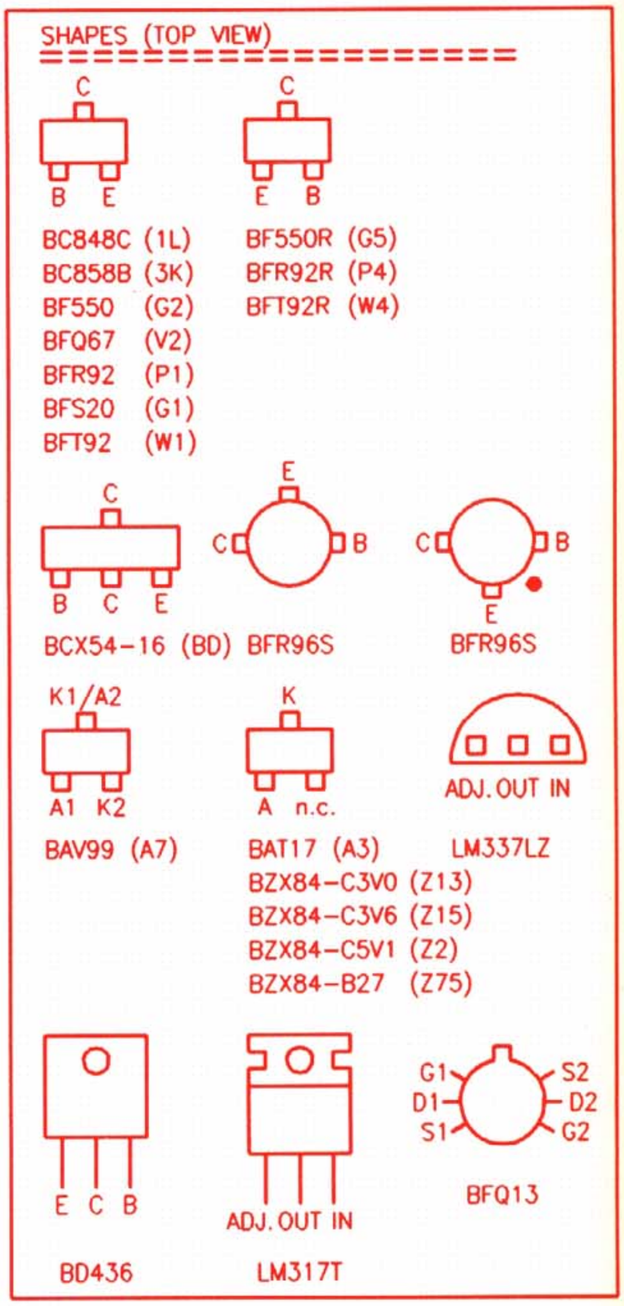
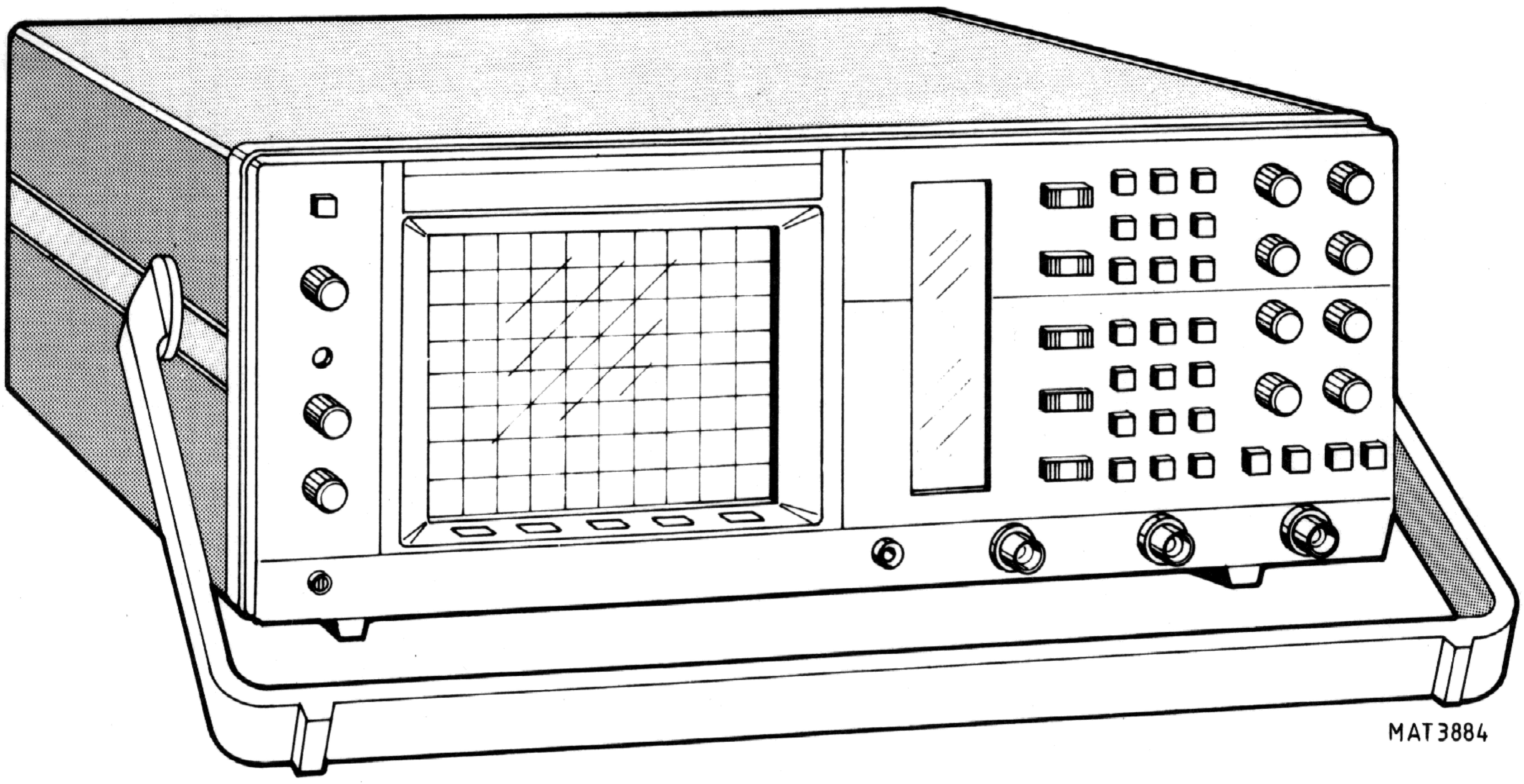


Figure 19.25 P²CCD unit

60 MHz Digital Storage Oscilloscopes
PM3350A/52A/55/57

Service Manual

4822 872 05341
900403



WARNING: These servicing instructions are for use by qualified personnel only. To avoid electric shock do not perform any servicing other than that contained in the Operating Instructions unless you are fully qualified to do so.

PHILIPS

PHILIPS

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1 SAFETY INSTRUCTIONS

Read these pages carefully before installation and use of the instrument.

1.1 INTRODUCTION

The following clauses contain information, cautions and warnings which must be followed to ensure safe operation and to retain the instrument in a safe condition. Adjustment, maintenance and repair of the instrument shall be carried out only by qualified personnel.

1.2 SAFETY PRECAUTIONS

For the correct and safe use of this instrument it is essential that both operating and servicing personnel follow generally-accepted safety procedures in addition to the safety precautions specified in this manual.
Specific warning and caution statements, where they apply, will be found throughout the manual.
Where necessary, the warning and caution statements and/or symbols are marked on the apparatus.

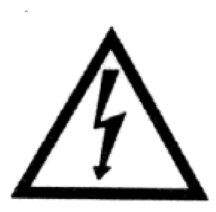
1.3 CAUTION AND WARNING STATEMENTS

CAUTION: **Is used to indicate correct operating or maintentance procedures in order to prevent damage to or destruction of the equipment or other property.**

WARNING: **Calls attention to a potential danger that requires correct procedures or pracites in order to prevent personal injury.**

1.4 SYMBOLS


High voltage ≥ 1000 V (red)


Live part (black/yellow)


Read the operating instructions


Static sensitive componnents (black/yellow)


Protective earth (grounding) terminal (black)

1.5 IMPAIRED SAFETY-PROTECTION

Whenever it is likely that safety-protection has been impaired, the instrument **must** be made inoperative and be secured against any unintended operation. The matter should then be referred to qualified technicians. Safety protection is likely to be impaired if, for example, the instrument fails to perform the intended measurements or shows visible damage.

1.6 GENERAL CLAUSES

WARNING: **The opening of covers or removal of parts, except those to which access can be gained by hand, is likely to expose live parts and accessible terminals which can be dangerous to live.**

- The instrument shall be disconnected from all voltage sources before it is opened.
- Bear in mind that capacitors inside the instrument can hold their charge even if the instrument has been separated from all voltage sources.

WARNING: **Any interruption of the protective earth conductor inside or outside the instrument, or disconnection of the protective earth terminal, is likely to make the instrument dangerous. Intentional interruption is prohibited.**

- Components which are important for the safety of the instrument may only be renewed by components obtained through your local Philips organisation. (See also section 23).
- After repair and maintenance in the primary circuit, safety inspection and tests, as mentioned in section 23 have to be performed.

2 CHARACTERISTICS

A. Performance Characteristics

Properties expressed in numerical values with stated tolerance are guaranteed by PHILIPS. Specified non-tolerance numerical values indicate those that could be nominally expected from the mean of a range of identical instruments.
This specification is valid after the instrument has warmed up for 30 minutes (reference temperature 23 °C).
For definitions of terms, reference is made to IEC Publication 351-1.

B. Safety Characteristics

This apparatus has been designed and tested in accordance with Safety Class I requirements of IEC Publication 348, Safety requirements for Electronic Measuring Apparatus, UL 1244 and CSA 556B and has been supplied in a safe condition.

C. Initial Characteristics

Overall dimensions:	
Width	
Including handle:	387 mm
Excluding handle:	350 mm
Length	
Including handle:	518,5 mm
Excluding handle, excl. knobs:	443,5 mm
Excluding handle, incl. knobs:	455,5 mm
Height	
Including feet:	146,5 mm
Excluding feet:	134,5 mm
Excl. under-cabinet:	132,5 mm

Figure 2.1 Dimensions of oscilloscope .

Mass: 9,5 kg

Operating positions:
a. Horizontally on bottom feet
b. Vertically on rear feet
c. On the carrying handle in two sloping positions

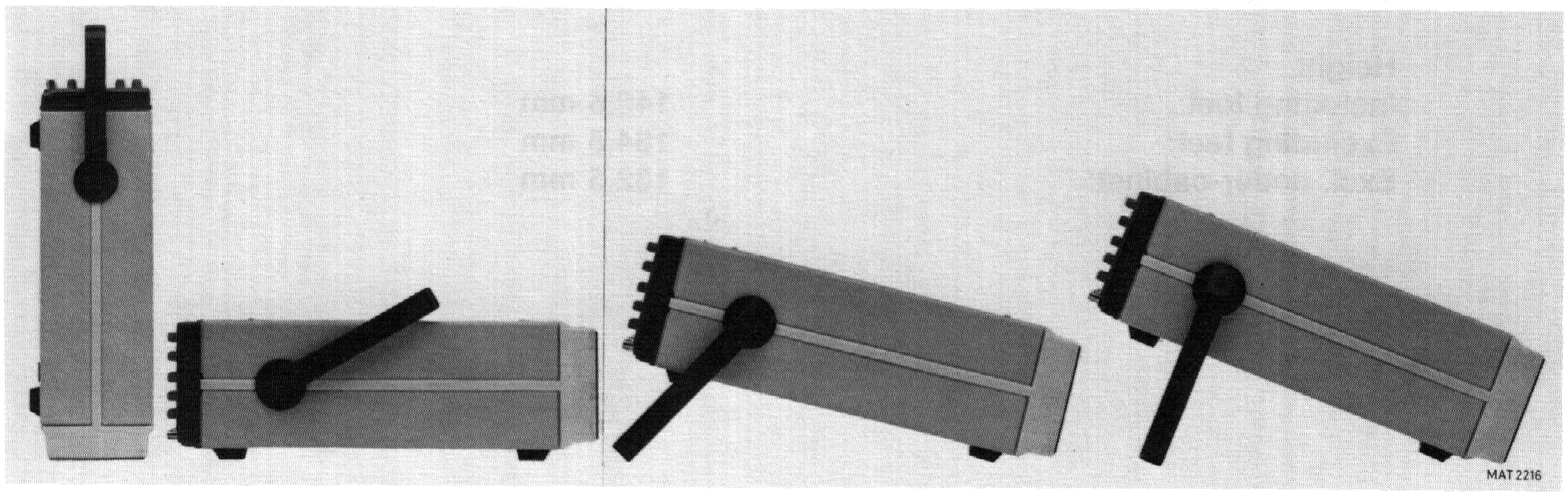


Figure 2.2 Operating positions

CHARACTERISTICS	SPECIFICATION	ADDITIONAL INFORMATION

2.1 DISPLAY

CHARACTERISTICS	SPECIFICATION	ADDITIONAL INFORMATION
* CRT		
Type number	PHILIPS D14-372	
Measuring area (h x w)	80 x 100 mm	8 x 10 div., 1 div. = 10 mm, 1 subdiv. (sd) = 2 mm
* Screen type		
Standard	GH (P31)	Standard persistence (7 ms)
Option	GM (P7)	Long persistence (30 ms)
* Total acceleration voltage	16 kV	
* Graticule:		
Engravings	Internal fixed	
Division lines	1 cm	Horizontal as well as vertical
Subdivisions	2 mm	Horizontal as well as vertical
Dotted lines	1,5 and 6,5 cm from top	Only horizontal
Percentages	0%, 10%, 90%, 100%	Left side only
* Orthogonality	90 ± 1°	Measured in zero point
* Illumination	Continuously variable	By means of potentiometer

2.2 VERTICAL DEFLECTION OR Y AXIS

CHARACTERISTICS	SPECIFICATION	ADDITIONAL INFORMATION
* Auto set	Automatic setting according to input signal	
* Deflection modes and sources	Channel A and/or B or ADDED (A + B, A-B)	Channel B can be inverted. All combinations are possible in ALTERNATE as well as in CHOP mode
* Deflection coefficients	2 mV/div...10 V/div	In 1, 2, 5 sequence. If probe with range indicator is used, deflection coeff. is automatically calculated in display
* Variable adjustment range	1 : > 2,5	
* Error limit	± 3%	Only in calibrated position
* Input impedance	1 MΩ ± 2%	Measured below 1 MHz
Paralleled by	20 pF ± 2 pF	Measured below 1 MHz

CHARACTERISTICS	SPECIFICATION	ADDITIONAL INFORMATION
* Max. input voltage	400 V (d.c. + a.c. peak)	
Max. test voltage (rms)	500 V	Max. duration 60 s.
* Bandwidth		
20 mV/div...10 V/div	≥ 60 MHz	Input 6 div. sine-wave.
2 mV/div...10 mV/div	≥ 35 MHz	Input 6 div. sine-wave.
* Rise-time		
20 mV/div. ... 10 V/div	< 5,8 ns	Calculated from 0,35/ f at -3 dB
2 mV/div. ... 10 mV/div	< 10 ns	Calculated from 0,35/ f at -3 dB
*Pulse aberration:		
Overshoot, ringing and rounding	< 1,5 sd peak to peak	Input pulse 5 div. + or-2,5 div. from screen centre, positive as well as negative pulse.
Duration of ringing	20ns	Ringing has ended when amplitude is 1/3 of starting amplitude.
Hole or bump	< 0,7 sd (peak)	
Drop or tilt	< 0,7 sd (peak)	
* Noise		
20 mV/div. ... 10 V/div	< 0,1 div	Visually measured. Pick up on open BNC excluded.
2 mV/div. ... 10 mV/div	< 0,25 div	Visually measured. Pick up on open BNC excluded.
* Lower -3 dB point	≤ 10 Hz	In AC position, 6 div. sine-wave
* Dynamic range		
d.c. ...10 MHz	> 24 div	Vernier in CAL position
10 MHz...60 MHz	> 8 div	Vernier in CAL position
* Min position range	± 8 div	Vernier in CAL position
* Cross talk between channels		Both channels same attenuator setting. Input max. 8 div. sine-wave.
At 10 MHz	1 : > 100	2, 5 and 10 V are excluded.
At 60 MHz	1 : > 50	2, 5 and 10 V are excluded.
* Common Mode Rejection Ratio		Both channels same attenuator setting, vernier adjusted for best CMRR; measured with max. 8 div. (± 4 div) each channel
at 1 MHz	1 : 100	
* Visible signal delay	> 15 ns	Max. intensity, measured from line start to trigger point.

CHARACTERISTICS	SPECIFICATION	ADDITIONAL INFORMATION
* Base line jump:		
between attenuator steps 20 mV...10 V	< 0,2 div	
Additional jump between 10 mV and 20 mV	< 0,3 div	
Normal Invert jump	< 0,2 div	Only channel B
ADD jump	< 0,6 div.	When A and B are positioned in screen centre (20 mV...10V).
Variable jump	< 0,2 div	Max. jump between any two positions of the variable potmeter

2.3 HORIZONTAL DEFLECTION OR X AXIS

2.3.1 Time-base

* Time coefficient	0,5 s/div...50 ns/div	In 1, 2, 5 sequence (magn. off)
Error limit	< ± 3 %	Measured at -4... + 4 div. from screen centre.
* Horizontal position range	Start of sweep and 10th div. can be shifted at least 0,5 div over screen centre	
* Variable control ratio	1 : > 2,5	
* Time-base magnifier	Expansion x10	Not valid in X-deflection.
Error limit	< ± 4 %	Measured at + 4...-4 div. from screen centre. Excluding first 50 ns and last 50 ns.
* Horizontal magnifier balance	< 0,5 div	Shift start of sweep in x10 in mid-screen position, then switch to x1.
* Hold-Off		
Min to max hold-off time ratio	1 : > 10	Minimum hold-off time is related to time-base setting.

2.3.2 X-deflection

* Deflection coeff.		
Via channel A or B	2 mV/div...10 V/div	In 1, 2, 5 sequence + variable
Via EXT input	100 mV/div	
* Error limit		
Via channel A or B	< ± 5%	
Via EXT input	< ± 5%	
* Bandwidth	DC...≥ 2 MHz	DC coupled

CHARACTERISTICS	SPECIFICATION	ADDITIONAL INFORMATION
* Phase shift between X and Y-deflection	< 3° DC...100 kHz	DC coupled
* Dynamic range	> ± 12 div DC...100 kHz	DC coupled

2.3.3 **EXT input**

* Input impedance Paralleled by	1 MΩ ± 2% 20 pF ± 2 pF	Measured below 1 MHz Measured below 1 MHz
* Max. input voltage (d.c. + a.c. peak) Max. test voltage (rms)	 400 V 500 V	 Max. duration 60 s.
* Lower -3 dB point	< 10 Hz	AC coupled

2.4 TRIGGERING

* Trig. mode AUTO (auto free run)	 Bright line in absence of trigger signal	 Auto free run starts 100 ms (typ.) after no trigger pulse.
TRIGGERED		Switches automatically to free run if one of the display channels is grounded.
SINGLE		In multi-channel mode (alternate) each channel is armed after reset; if sweep has already started, sweep is not finished. Not applicable in peak-to-peak coupling
* TRIGGER SOURCE	A, B, Composite (A/B), EXT, Line	In line, trigger source is always the mains. Line trigger amplitude depends on line input voltage. Approx. 6 div. at 220 V mains voltage and 50 Hz frequency.
* TRIGGER COUPLING	Peak-to-peak (p-p), DC, TVL, TVF, LF, HF	
* LEVEL range Peak-to-peak:	 Related to peak-to-peak value	 p-p coupling is DC rejected
DC internal	> ± 8 div.	
DC external	> ± 800 mV	
TVL/TVF	Fixed level	
HF	50 kHz ... 100 MHz	
LF	DC ... 50 kHz	

CHARACTERISTICS	SPECIFICATION	ADDITIONAL INFORMATION
* Trigger slope	+/-	Slope sign in LCD. For TVL/TVF, + or - is used to indicate positive or negative video
* TRIGGER SENSITIVITY		
Internal		
DC...10 MHz	>0,5 div.	Trig. coupling DC.
At 50 MHz	>1,0 div.	Trig. coupling DC.
At 100 MHz	>3,0 div.	Trig. coupling DC.
External		
DC...10 MHz	>50 mV	Trig. coupling DC.
At 50 MHz	>150 mV	Trig. coupling DC.
At 100 MHz	>500 mV	Trig. coupling DC.
TVL/TVF internal	>0,7 div.	Sync. pulse
TVL/TVF external	>70 mV	Sync. pulse

2.5 SIGNAL ACQUISITION

* Sampling type		
at 50 s/div. ...0,5μs/div.	Real time	For PM3350A/52A
at 50 s/div ... 0,2 μs/div.	Real time	For PM3355/57
* Maximum sample rate:		Sample rate depends on time/div setting
Real time	100 megasamples/s	For PM3350A/52A
	250 megasamples/s	For PM3355/57
* Vertical (voltage) resolution	8 bits	0,4% of full range of 10 divisions.
* Horizontal (time) resolution:		
in single channel acquisition		
at 50 s/div...5 ms/div	4096 samples/acquisition	1 Sample = 0,025% of full record.
at 2ms/div...0,5 μ s/div	512 samples/acquisition	For PM3350A/52A 1 Sample = 0,2% of full record.
at 2 ms/div...0,2 μs/div	512 samples/aquisition	For PM3355/57 1 Sample = 0,2% of full record.
in dual channel acquisition		
at 50 s/div...5 ms/div	2048 samples/acquisition	1 Sample = 0,05% of full record.
at 2 ms/div...0,5 μs/div	512 samples/acquisition	For PM3350A/52A 1 Sample = 0,2 % of full record.
at 2 ms/div...0,2 μs/div	512 samples/aquisition	For PM3355/57 1 Sample = 0,2% of full record

CHARACTERISTICS	SPECIFICATION	ADDITIONAL INFORMATION
* Record length	10,2 x time/div	Display in unmagnified position.
* Acquisition time		
real-time:	10,2 x time/div	
at 5 ms/div...0,5 μs/div	+30 ms...50 ms	For PM3350A/52A exclusive delay time
at 2 ms/div...0,2 μs/div	+30 ms...50 ms	For PM3355/57 exclusive delay time
at 0,5 s/div...5 ms/div	+50 ms...70ms	exclusive delay time
* Sources	Channel A, Channel B	Channel B can be inverted before acquisition
* Acquisiton modes	1 Channel only	Full memory available for 1 channel
	2 Channels	Simultaneously sampled; 2 channels share memory.

2.6 CHANNELS A AND B

* Frequency response:		Z source = 25 Ω
Lower transition point of BW:		
Input coupling in DC position	d.c.	
Input coupling in AC position	≤ 10 Hz	
Upper transition point of BW (amb 15...35°C)		Deviation max. 3 MHz for ambient 0...40°C.
10 V ... 2 mV	≥ 20 MHz (-3 dB)	For PM3350A/52A
10 V ... 20 mV	≥ 35 MHz (-3 dBO	For 3355/57
10 mV ... 2 mV	≥ 20 MHz (-3 dB)	For 3355/57
*Max. base line instability:		
Jump (Ambient: 15...35°C):		Add 25% for ambient 0...40°C.
when switching to memory mode:	0,3 div	Add 0,5 div for 0,5 μs/div and 1 μs/div
when actuating INVertor switch	0,3 div	
between any time/div positions	0,5 div	
Drift	0,1 div/K	Measured in 20 mV/div position
Temperature coef.	± 0,05 div/K	Measured in 20 mV/div position

CHARACTERISTICS	SPECIFICATION	ADDITIONAL INFORMATION

2.7 TIME BASE

* Modes	Recurrent	
	Single shot	
	Multiple shot	Up to 2 shots
	Roll	Will be stopped by trigger
	Zoom	The part of the trace between the cursors will be magnified by doing a new acquisition with adopted trigger delay and time/div
* Time coefficients:		
In recurrent	0,5 s/div...0,2 μ s/div	For PM3350A/52A
	0,5 s/div...0,2 μs/div	For PM3355/57
In single shot and multiple shot	50 s/div...0,5 μs/div	For PM3350A/52A
	50 s/div...0,2 μs/div	For PM3355/57
Error limit (Ambient: 15...35°C)		
In real time mode	± 1 %	Add 0,5 % for ambient: 0...40°C
up to memory	± 0,1%	To be measured via remote control only

2.8 TRIGGER

* Trigger delay range:		
In real time		Selectable in divisions.
	-10... +2500 div	For PM3350A/52A
	-10... + 5000 div	For 3355/57
In equivalent time	0... +20 div	Selectable in divisions.
Accuracy	± 0,3 div	
* Trigger level view		Indication in LCD
Inaccuracy	≤ 0,5 div	

2.9 MEMORY

* Memory size:		
Registers	4	
Register depth:		
acquisition	4096 words	
register	4096 words	
Wordlength	8 bits	
* Functions	Clear	
	Load	Contents of acquisition are saved in register
	Lock	Memory system is locked. If lock is not active the signal is written into the acquisition memory.
*Front setting memory size	64 front settings	

CHARACTERISTICS	SPECIFICATION	ADDITIONAL INFORMATION

2.10 DISPLAY

* Sources	Channel A, Channel B, Reference register, R1 or R2 or R3	In any combination
* Display expansion horizontal	1x...32x	Value of trigger delay setting in LCD is based on unmagnified display
* Display manipulations	dot join	Including digital interpolation at 0,5 μs/div...2 ms/div for PM3350A/52A or 0,2 μs/div...2ms/div for PM3355/57.
* Display part range horizontal	full memory	The displayed part of the magnified memory can be chosen

2.11 CALCULATION FACILITIES

* Functions	Frequency,	Between cursors indicated by markers.
	Period, Pulse width, Rise or fall time, Peak-to-peak value, Root mean square value, Mean value, dV, dt Average Envelope	

2.12 AUTO SETTING

* Settling time	3 s (typical)	Auto set is done in analog mode.
*Cursors or calculation	off	

2.13 CURSORS

* Horizontal resolution:		
in single channel mode	1 : 4096	
in dual channel mode	1 : 2048	
at 2 ms/div...0,5 μs/div		For PM3350A/52A
	1 : 512	display in dots
	1 : 1024	display in dot-join
at 2 ms/div...0,2 μs/div		For PM3355/57
	1 : 512	display in dots
	1 : 1024	display in dot-join

CHARACTERISTICS	SPECIFICATION	ADDITIONAL INFORMATION
* Vertical resolution	1 : 256	over 10 div
* Read out resolution	3 Digits	
* Voltage cursors: Error limit, amb. 15...35°C	± 3 %	Referred to input at BNC, error of probes etc. excluded. Add 3% for ambient 0...40°C.
Cursor range	Displayed part of memory	Cursors can not pass each other. (X-position is ignored).

2.14 POWER SUPPLY

* Line input voltage a.c.:		One range
Nominal	100 V...240 V	
Limits of operation	90 V...250 V	
* Line frequency:		
Nominal	50 Hz...400 Hz	
Limits of operation	43 Hz...445 Hz	
* Safety requirements within specification of: IEC 348 CLASS I UL 1244 VDE 0411 CSA 556 B		
* Power consumption (AC source)		At nominal source voltage
Nominal	70 W	For PM3350A/52A
	80 W	For PM3355/57

2.15 SUNDRIES

* Z-MODulation		TTL-compatible
ViH	≥ 2,0 V	Blanks display.
ViL	≤ 0,8 V	Max. intensity.
Minimum pulse width for blanking	25 ns	Analog control between ViH and ViL is possible.
* CAL output		To calibrate drop or tilt of probes. The output may be short-circuited to ground.
Output voltage	1,2 V ± 1%	Rectangular output voltage.
Frequency	2 kHz	
* Data and settings retention:		When instrument is switched off or during mains failure. The oscilloscope settings and traces are saved.

CHARACTERISTICS	SPECIFICATION	ADDITIONAL INFORMATION
Memory back-up voltage	2...3,5 V	
Memory back-up current drain	Typical 25 μA	At 25°C
Recommended batteries		According to IEC285 (=Alkaline Manganese Penlight Battery)
type	LR 6	e.g. PHILIPS LR 6.
quantity	2 pcs	Delivered with the instrument.
temperature rise of batteries	20 K	After warming-up period of instrument.
Retention time	typical 5 years	At 25°C, with recommended (fresh) batteries.
* Temperature range	0... +70°C	At -40...0°C settings retention is uncertain. It is advised to remove batteries from the instrument when it is stored during longer (24h) period below -30°C or above 60°C. WARNING: UNDER NO CIRCUMSTANCES BATTERIES SHOULD BE LEFT IN INSTRUMENT AT TEMPERATURES BEYOND THE RATED RANGE OF THE BATTERY SPECIFICATIONS!
* Analog plot output		
Connector	DIN plug 9 pin female	
Functions	Memory dump	Register selectable
Sensitivity	1 V/full memory ± 3%	Horizontal and vertical
Pen lift	TTL compatible	Pen-up is software selectable (0 or 1). Open collector output; max. 12 V.
Plot time per dot	20 ms...2000 ms	Software selectable
Plot sequence	Channel A first	In dual channel operation; with more registers, starting with lowest number.

2.16 ENVIRONMENTAL CHARACTERISTICS

The environmental data mentioned in this manual are based on the results of the manufacturer's checking procedures. Details on these procedures and failure criteria are supplied on request by the PHILIPS/FLUKE organisation in your country, or by PHILIPS, INDUSTRIAL AND ELECTRO-ACOUSTIC SYSTEMS DIVISION, EINDHOVEN, THE NETHERLANDS.

* Meets environmental requirements of:	MIL-T-28800 C, type III, CLASS 5 Style D	Except for front cover.

CHARACTERISTICS	SPECIFICATION	ADDITIONAL INFORMATION
* Temperature:		
operating temp. range within specification	10°C...40°C	MIL-T-28800 C par. 3.9.2.3. tested cf. par. 4.5.5.1.1.
Limits of operating temperature range	0°C...40°C	MIL-T-28800 C par. 3.9.3.3. tested cf. par. 4.5.5.1.1.
Non-operating (storage):	-40°C... +75°C	Cf. MIL-T-28800 C parr. 3.9.2.3. tested cf. par. 4.5.5.1.1.
* Max. humidity operating/non-operating	95% RH	10...30°C
* Max. altitude:		MIL-T-28800 C par. 3.9.3. tested, par. 4.5.5.2.
Operating	4,5 km (15000 feet)	Maximum (Operating temperature derated 3°C for each km, for each 3000 feet, above sea level).
Non-operating (storage)	12 km (40 000 feet)	
* Vibration (operating)		MIL-T-28800 C par. 3.9.4.1. tested, par. 4.5.5.3.1.
Freq. 5...15 Hz		
Sweep time	7 min.	
Excursion (p-p)	1,5 mm	
Max acceleration	7 m/s^2 (0,7 x g)	at 15 Hz
Freq. 15...25 Hz		
Sweep time	3 min.	
Excursion (p-p)	1 mm	
Max acceleration	13 m/s^2 (1,3 x g)	at 25 Hz
Freq. 25...55 Hz		
Sweep time	5 min.	
Excursion (p-p)	0,5 mm	
Max acceleration	30 m/s^2 (3 x g)	at 55 Hz
Resonance dwell	10 min.	at each resonance freq. (or at 33 Hz if no resonance was found). Excursion, 9.7.1. to 9.7.2.
* Shock (operating)		MIL-T-28800 C par. 3.9.5.1. tested, par. 4.5.5.4.1.
Amount of shocks		
total	18	
each axis	6	3 in each direction
Shock wave-form	Half sine-wave	
Duration	11 ms	
Peak acceleration	300 m/s^2 (30 x g)	
* Bench handling		MIL-T-28800 C par. 3.9.5.3. tested, cf. par. 4.5.5.4.3.
Meets requirements of	MIL-STD-810 method 516, proced. V	

CHARACTERISTICS	SPECIFICATION	ADDITIONAL INFORMATION
* Salt atmosphere		MIL-T-28800 C par. 3.9.8.1. tested, par. 4.5.6.2.1.
Structural parts meet requirements of	MIL-STD-810 method 509, proced. I salt solution 20%	
* EMI (Electronic Magnetic Interference) meets requirements of	MIL-STD-461 CLASS B	Applicable requirements of part 7
	CE03, CE07 CS01, CS02, CS06 RS02, RS03	No malfunction
* Magnetic radiated susceptibility Maximum deflection factor	2 mm/Gs	Tested conforming IEC 351-1 par 5.1.3.1 Measured with instrument in a homogeneous magnetic field (in any direction with respect to instrument) with a flux intensity (p-p value) of 1,42 mT (14,2 gauss) and of symmetrical sine-wave form with a frequency of 45 Hz...66 Hz

2.17 SAFETY

* Meets requirements of	IEC 348 CLASS I	
	VDE 0411	Except for power cord, unless shipped with Universal European power plug.
	UL 1244	Except for power cord, unless shipped with North American power plug
	CSA 556 B	

3 INTRODUCTION TO CIRCUIT DESCRIPTION AND BLOCK DIAGRAM DESCRIPTION

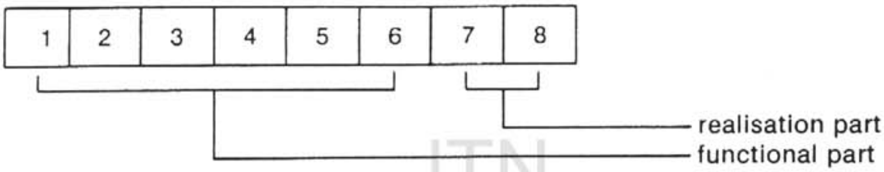
3.1 INTRODUCTION TO CIRCUIT DESCRIPTION

3.1.1 General

The functioning of the circuits is described per printed-circuit board (p.c.b.). For every p.c.b. a separate chapter (4...19) is available containing the lay out of the p.c.b., the associated circuit diagram(s), the circuit description and a signal name list.

3.1.2 Explanation of signal name set-up

Signal name consists of two parts:
- a functional part of maximal 6 characters
- a realisation part of 2 characters



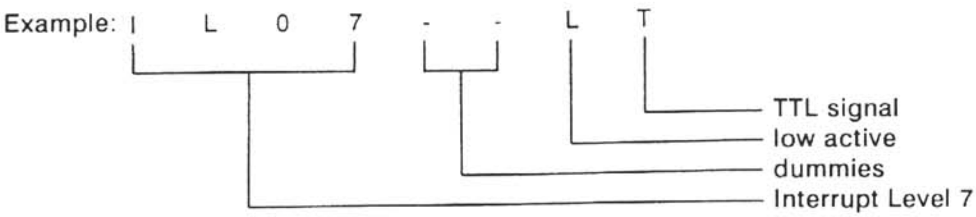
The realisation part is optional. If it is used then the functional parts should consist of 6 characters. If necessary dummies (minus sign)are used in the functional part, to make it 6 characters long.

The first character of the realisation part has the following meaning:

H:	active high signal
L:	active low signal
X:	irrelevant (e.g. counter outputs)

The second character of the realisation part is used to identify signal levels:

A:	analog
C:	CMOS 12 V or 15 V
D:	CMOS 5 V
E:	ECL -4,5 V or -5,2 V
T:	TTL 5 V or HCT



Sometimes the realisation part can also be used for a serial number e.g. to indicate a buffered version of a signal.

Example: CHPT--01

Figure 3.1 Block diagram, analog part

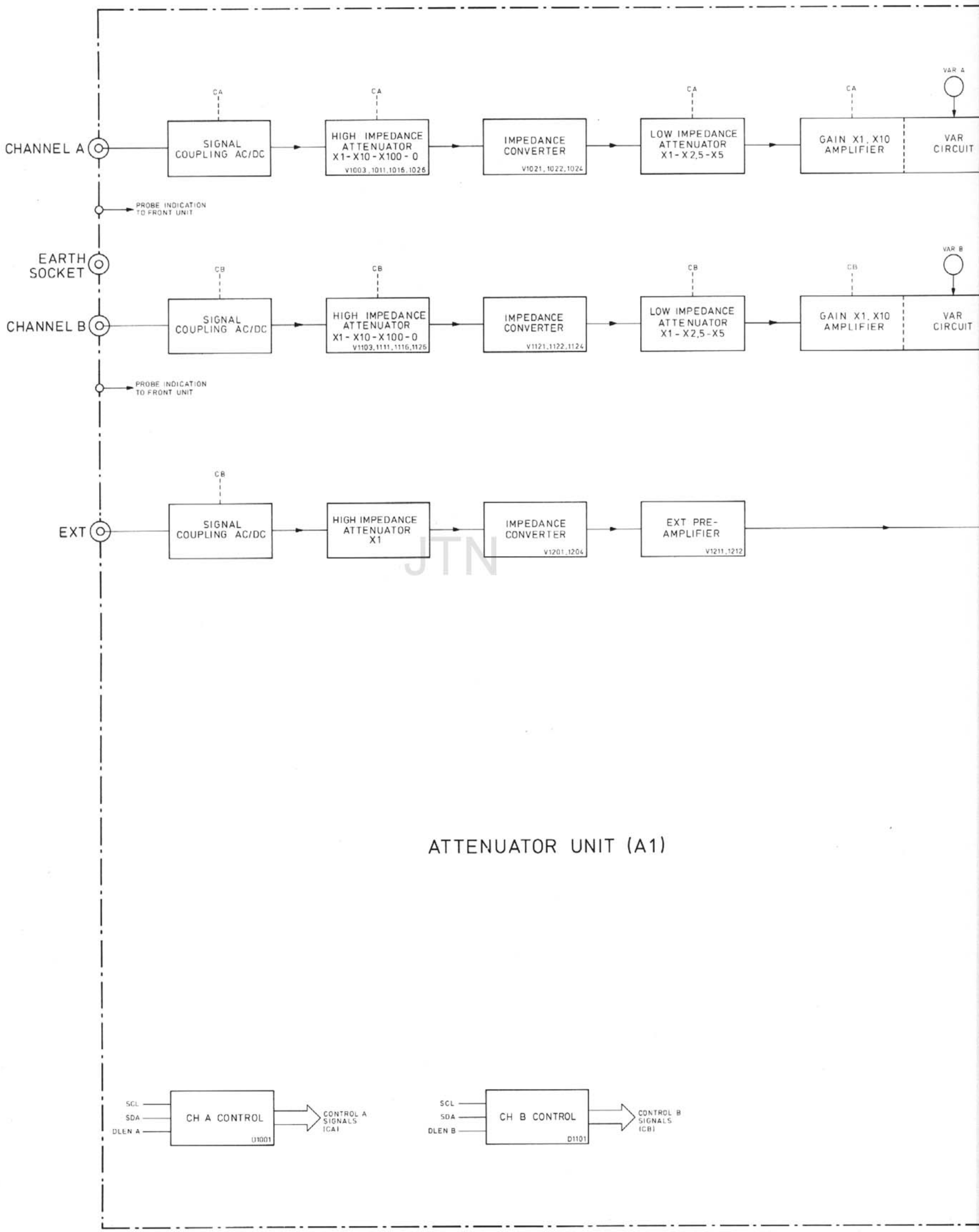
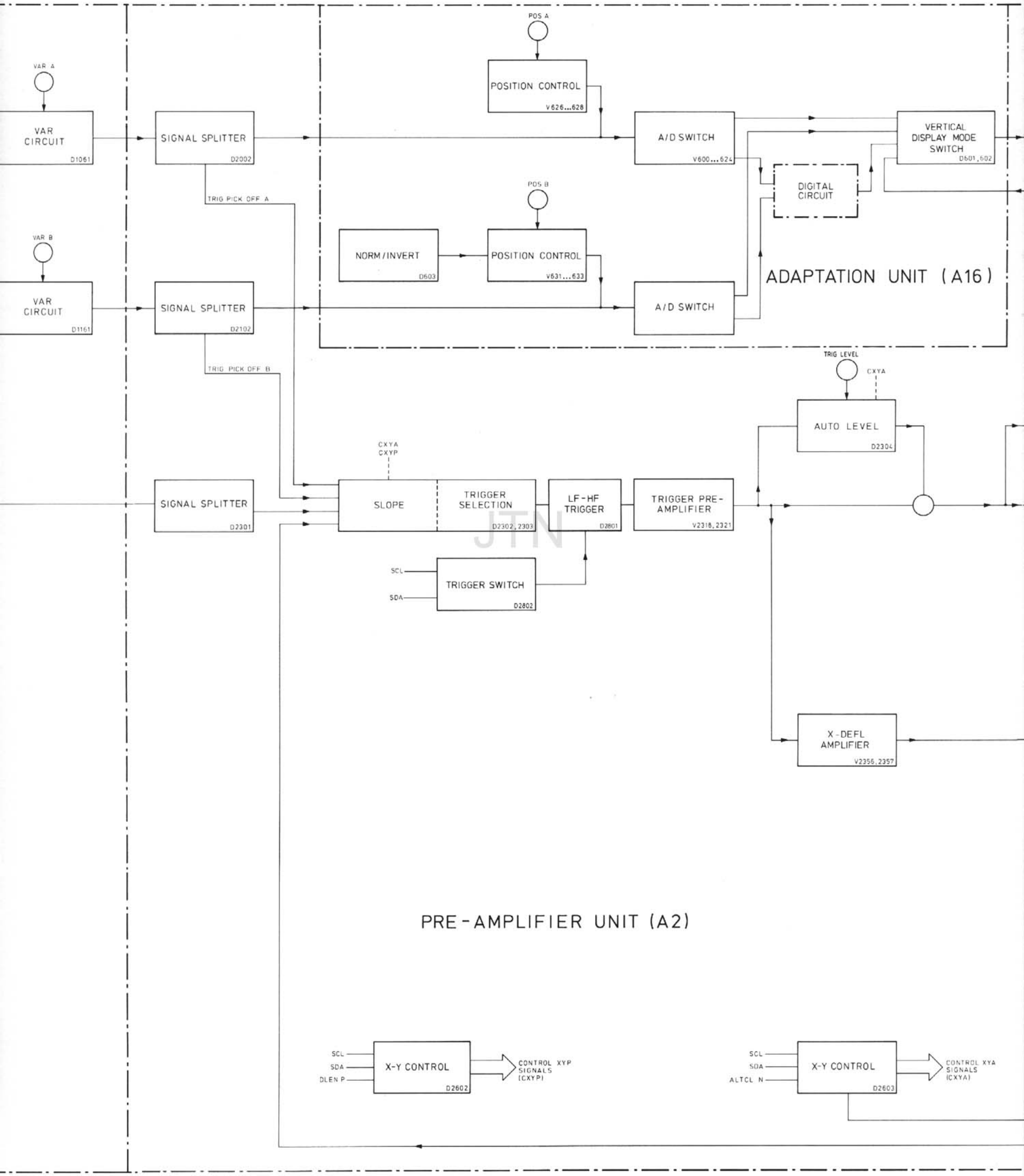
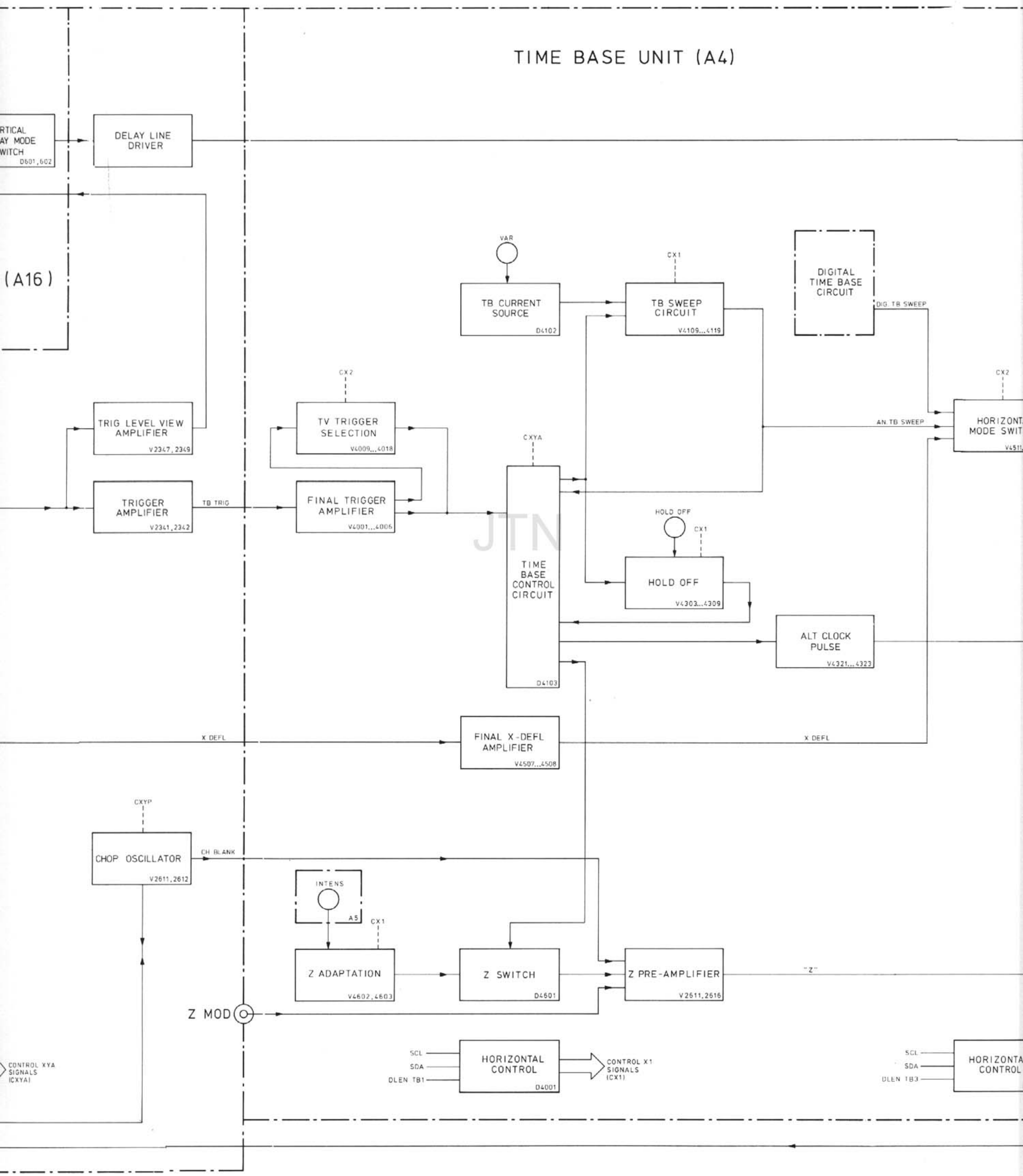
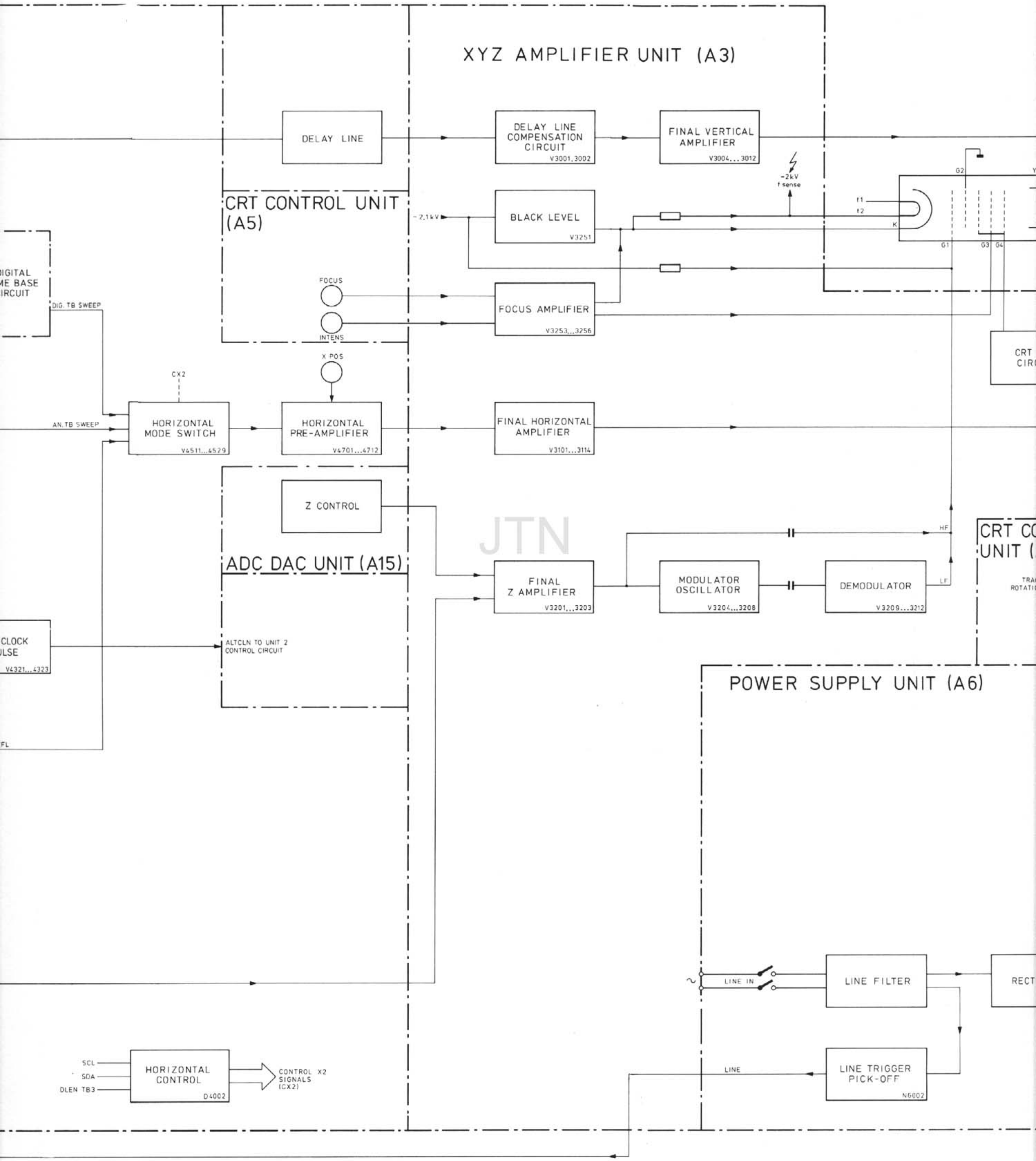


Figure 3.1 Block diagram, analog part

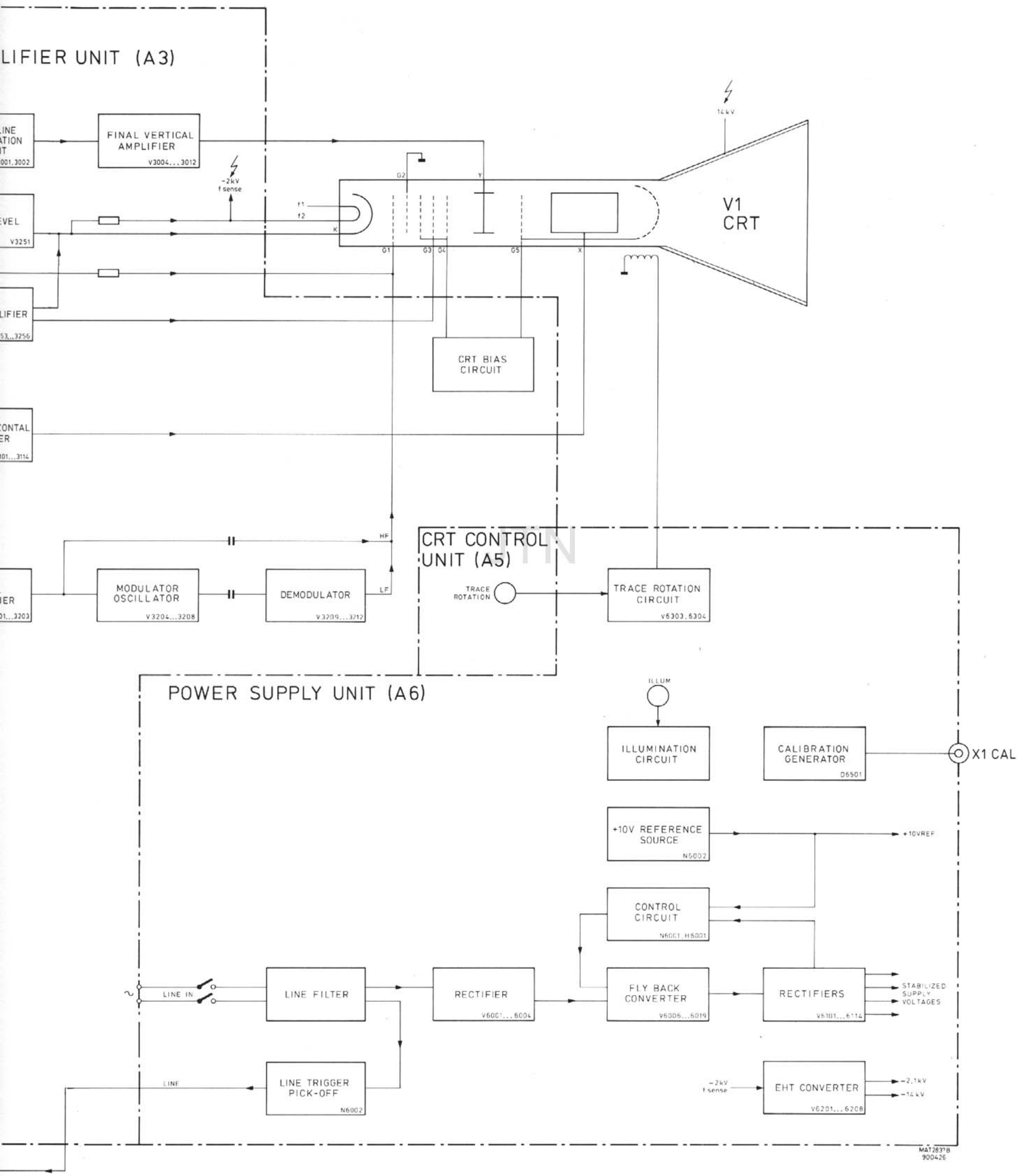

POS A
POSITION CONTROL
V626...628
VAR A
VAR CIRCUIT
D1061
SIGNAL SPLITTER
D2002
A/D SWITCH
V600...624
VERTICAL DISPLAY MODE SWITCH
D601,602
DIGITAL CIRCUIT
TRIG PICK OFF A
POS B
VAR B
NORM/INVERT
D603
POSITION CONTROL
V631...633
ADAPTATION UNIT (A16)
VAR CIRCUIT
D1161
SIGNAL SPLITTER
D2102
A/D SWITCH
TRIG PICK OFF B
TRIG LEVEL
CXYA
AUTO LEVEL
D2304
CXYA
CXYP
SIGNAL SPLITTER
D2301
SLOPE
TRIGGER SELECTION
D2302,2303
LF-HF TRIGGER
D2801
TRIGGER PRE-AMPLIFIER
V2318,2321
SCL
SDA
TRIGGER SWITCH
D2802
X-DEFL AMPLIFIER
V2356,2357
PRE-AMPLIFIER UNIT (A2)
SCL
SDA
DLEN P
X-Y CONTROL
D2602
CONTROL XYP SIGNALS (CXYP)
SCL
SDA
ALTCL N
X-Y CONTROL
D2603
CONTROL XYA SIGNALS (CXYA)



TIME BASE UNIT (A4)
(A16)
RTICAL
AY MODE
WITCH
D601, 602
DELAY LINE
DRIVER
VAR
TB CURRENT
SOURCE
D4102
CX1
TB SWEEP
CIRCUIT
V4109...4119
DIGITAL
TIME BASE
CIRCUIT
DIG. TB SWEEP
CX2
HORIZONTA
MODE SWIT
AN. TB SWEEP
CX2
TRIG LEVEL VIEW
AMPLIFIER
V2347, 2349
TV TRIGGER
SELECTION
V4009...4018
CXYA
TRIGGER
AMPLIFIER
V2341, 2342
TB TRIG
FINAL TRIGGER
AMPLIFIER
V4001...4006
TIME
BASE
CONTROL
CIRCUIT
D4103
HOLD OFF
CX1
HOLD OFF
V4303...4309
ALT CLOCK
PULSE
V4321...4323
X DEFL
FINAL X-DEFL
AMPLIFIER
V4507...4508
X DEFL
CXYP
CHOP OSCILLATOR
V2611, 2612
CH BLANK
INTENS
A5
CX1
Z ADAPTATION
V4602, 4603
Z SWITCH
D4601
Z PRE-AMPLIFIER
V2611, 2616
"Z"
Z MOD
CONTROL XYA
SIGNALS
(CXYA)
SCL
SDA
DLEN TB1
HORIZONTAL
CONTROL
D4001
CONTROL X1
SIGNALS
(CX1)
SCL
SDA
DLEN TB3
HORIZONTA
CONTROL



XYZ AMPLIFIER UNIT (A3)
DELAY LINE
DELAY LINE COMPENSATION CIRCUIT
V3001,3002
FINAL VERTICAL AMPLIFIER
V3004...3012
CRT CONTROL UNIT (A5)
~2,1kV
BLACK LEVEL
V3251
-2kV f sense
f1
f2
K
G1
G2
G3
G4
FOCUS
INTENS
FOCUS AMPLIFIER
V3253...3256
DIGITAL TIME BASE CIRCUIT
DIG. TB SWEEP
X POS
CX2
AN. TB SWEEP
HORIZONTAL MODE SWITCH
V4511...4529
HORIZONTAL PRE-AMPLIFIER
V4701...4712
FINAL HORIZONTAL AMPLIFIER
V3101...3114
Z CONTROL
ADC DAC UNIT (A15)
FINAL Z AMPLIFIER
V3201...3203
MODULATOR OSCILLATOR
V3204...3208
DEMODULATOR
V3209...3212
HF
LF
CLOCK PULSE
V4321...4323
ALTCLN TO UNIT 2 CONTROL CIRCUIT
POWER SUPPLY UNIT (A6)
LINE IN
LINE FILTER
LINE TRIGGER PICK-OFF
N6002
LINE
SCL
SDA
DLEN TB3
HORIZONTAL CONTROL
D4002
CONTROL X2 SIGNALS (CX2)



LIFIER UNIT (A3)
FINAL VERTICAL AMPLIFIER
V3004...3012
14 kV
-2kV f sense
V1 CRT
G2
Y
f1
f2
K
G1
G3
G4
G5
X
CRT BIAS CIRCUIT
MODULATOR OSCILLATOR
V3204...3208
DEMODULATOR
V3209...3212
HF
LF
CRT CONTROL UNIT (A5)
TRACE ROTATION
TRACE ROTATION CIRCUIT
V6303, 6304
POWER SUPPLY UNIT (A6)
ILLUM
ILLUMINATION CIRCUIT
CALIBRATION GENERATOR
D6501
X1 CAL
+10V REFERENCE SOURCE
N5002
+10VREF
CONTROL CIRCUIT
N6001, H6001
LINE IN
LINE FILTER
RECTIFIER
V6001...6004
FLY BACK CONVERTER
V6006...6019
RECTIFIERS
V6101...6114
STABILIZED SUPPLY VOLTAGES
LINE
LINE TRIGGER PICK-OFF
N6002
-2kV f sense
EHT CONVERTER
V6201...6208
-2,1kV
-14 kV
MAT2837B
900426

Signal name list:

The digital unit description in Chapters 12...19 contains a list with the signal names used in that unit given in alphabetical order.
After each name, a description is given and on which unit the signal is generated. Only if the signal is generated on the unit itself, are the other units on which the signal is used (signal destination(s)) mentioned, otherwise a minus sign is filled in. If the signal flows over more units in sequence, the path is indicated.

Some signals may have more signal sources, because the sources have open-collector output circuits, or 3-state output circuits. In this case the sources are mentioned, separated with a plus (+) sign.

A number of power supply lines and ground lines are not mentioned on the signal name lists because they appear in almost every unit.

3.1.3 Location of electrical parts

The item numbers of C...., R...., V...., N...., D.... and K.... have been divided into groups which relate to the circuit and the printed-circuit board according to the following table:

Item number	Unit no.	Printed-circuit board
1000-1599	A1	Attenuator unit
2000-2999	A2	Pre-amplifier unit
3000-3999	A3	XYZ amplifier unit
4000-4999	A4	Time base unit
5000-5099	A5	CRT control unit
6000-6999	A6	Power-supply unit
7000-7999	A7	Front unit
8000-8999	A8	LCD unit
200- 299	A12	CPU unit
300- 399	A13	DCL unit
400- 499	A14	ACL unit
500- 599	A15	ADC DAC unit
600- 699	A16	Adaptation unit
700- 799	A17	Mini CCD (PM3350A/52A only)
800- 999	A18	P^2CCD unit
5100-5999	A18	P^2CCD unit (PM3355/57 only)

3.2 BLOCK DIAGRAM DESCRIPTION

(see figure 3.1 and 3.2)

3.2.1 Introduction

This block diagram description is based around all the important functional blocks and their interconnections. The interconnections between all p.c.b.'s are given in the interconnection diagram of figure 23.6. In order to assist in cross-reference with the circuit diagrams, the blocks in the block diagram include the item numbers of the active components they contain.
Furthermore, the blocks are grouped together per printed-circuit board, or a part of it. To facilitate reference, the names of the functional blocks are given in text in CAPITALS.
Signal waveforms are also indicated at block interconnections where useful.
In this instrument almost all the switches (UP-DOWN controls, softkeys and potentiometer UNCAL switches) influence the oscilloscope circuits via a microprocessor (μP) system.

3.2.2 Attenuator unit (unit A1)

The vertical channels A and B for the signals to be displayed are identical. Each channel comprises an input SIGNAL COUPLING for AC/DC, a HIGH IMPEDANCE ATTENUATOR which gives signal attenuation of x1-x10 or x100, an IMPEDANCE CONVERTER, a LOW IMPEDANCE ATTENUATOR which gives signal attenuation of x1- x2,5 or x5 and a GAIN x1- x10 AMPLIFIER block, incorporated with the VAR CIRCUIT. This block has a variable gain, influenced by the front-panel VAR control. The gain is also increased by x10 in order to obtain 2 mV- 5 mV and 10mV settings.

Similar to the vertical channels, the external channel attenuator also has an input SIGNAL COUPLING, HIGH IMPEDANCE ATTENUATOR and IMPEDANCE CONVERTER in line. However, the external channel has only x1 attenuation and no LOW IMPEDANCE ATTENUATOR. The output of the external channel is fed to the EXT PRE-AMPLIFIER.

All blocks that are capable of working in different modes are controlled by the control A or control B signals. These signals are generated by the CH.A CONTROL or CH.B CONTROL blocks.

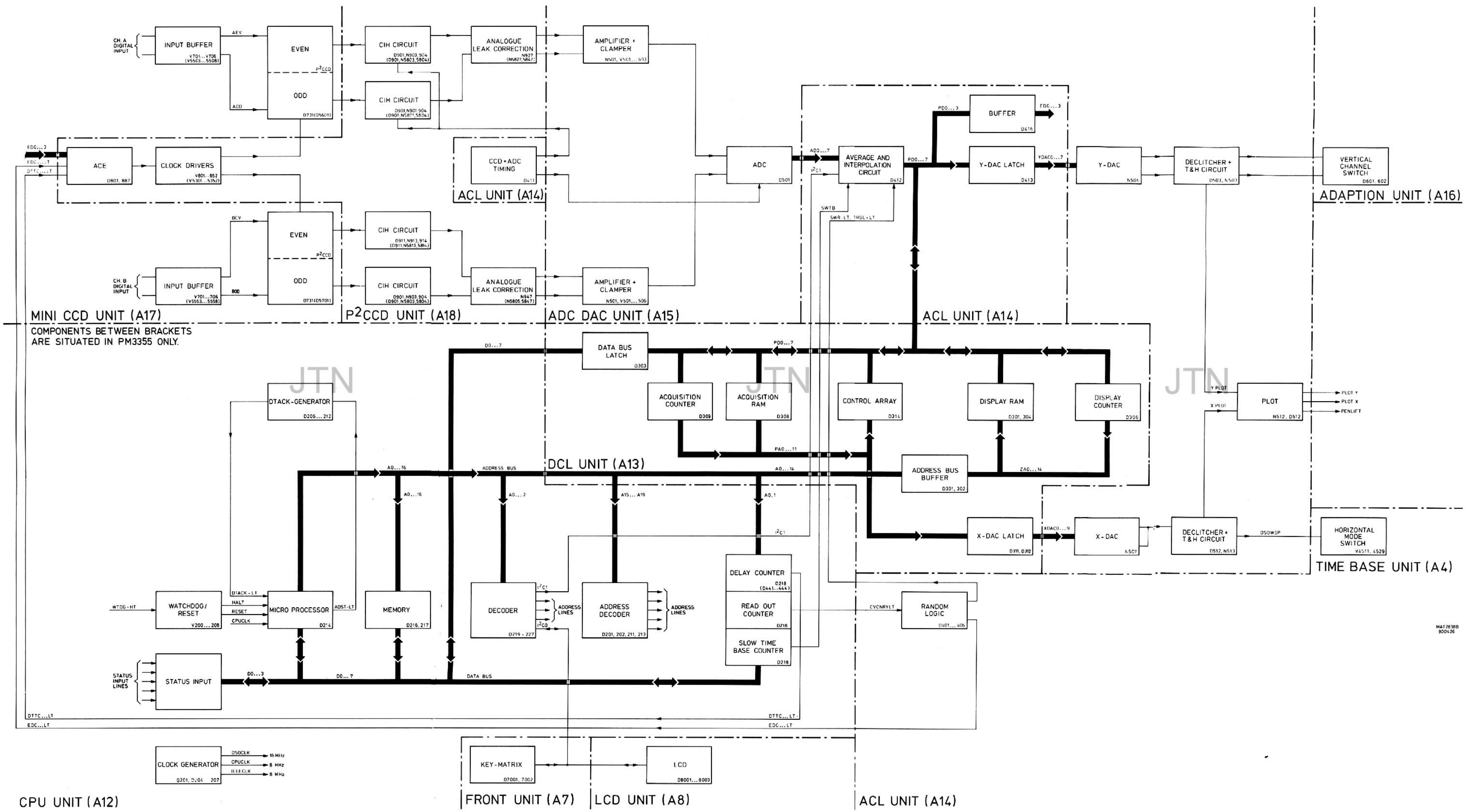


Figure 3.2 Block diagram, digital part

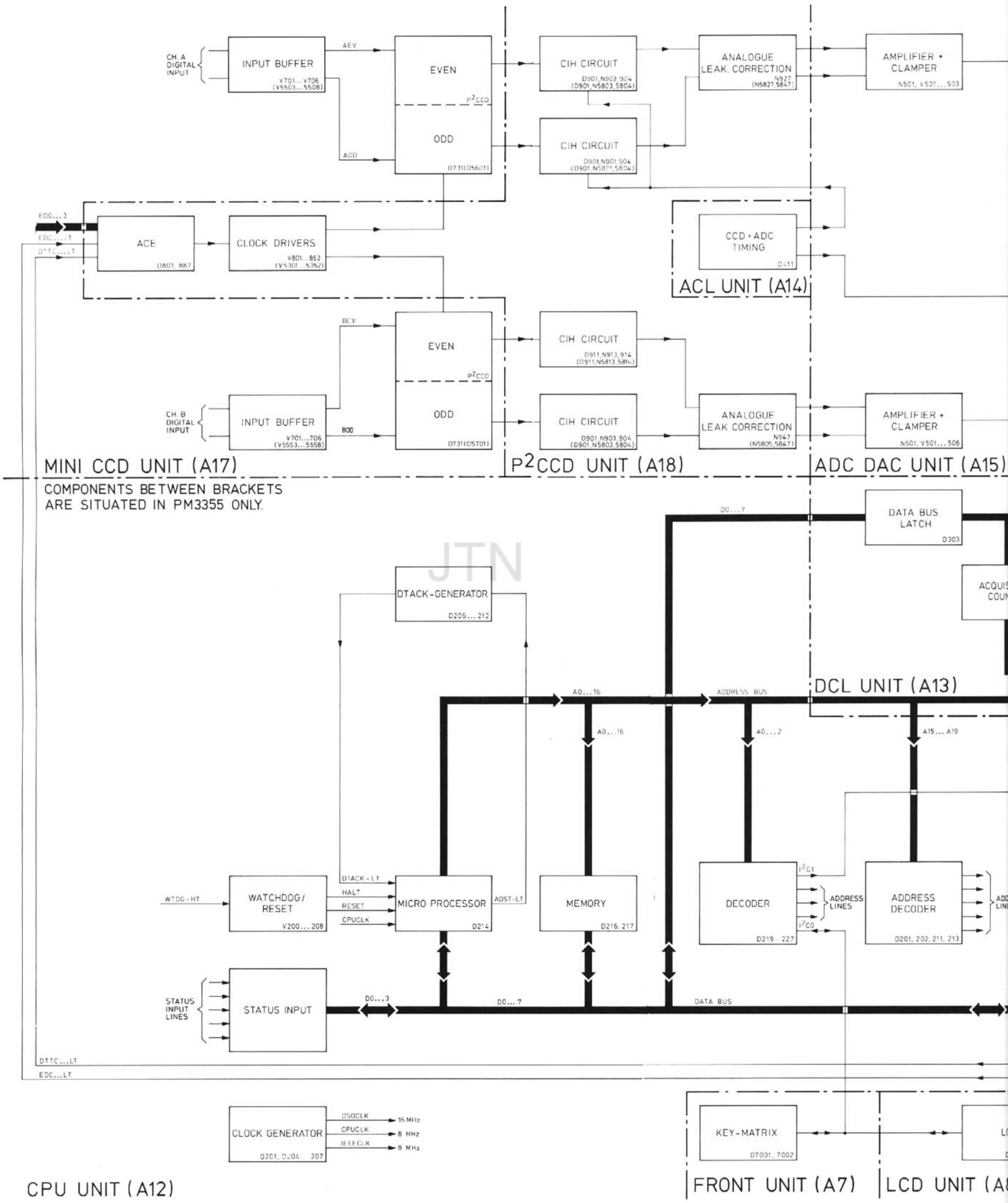
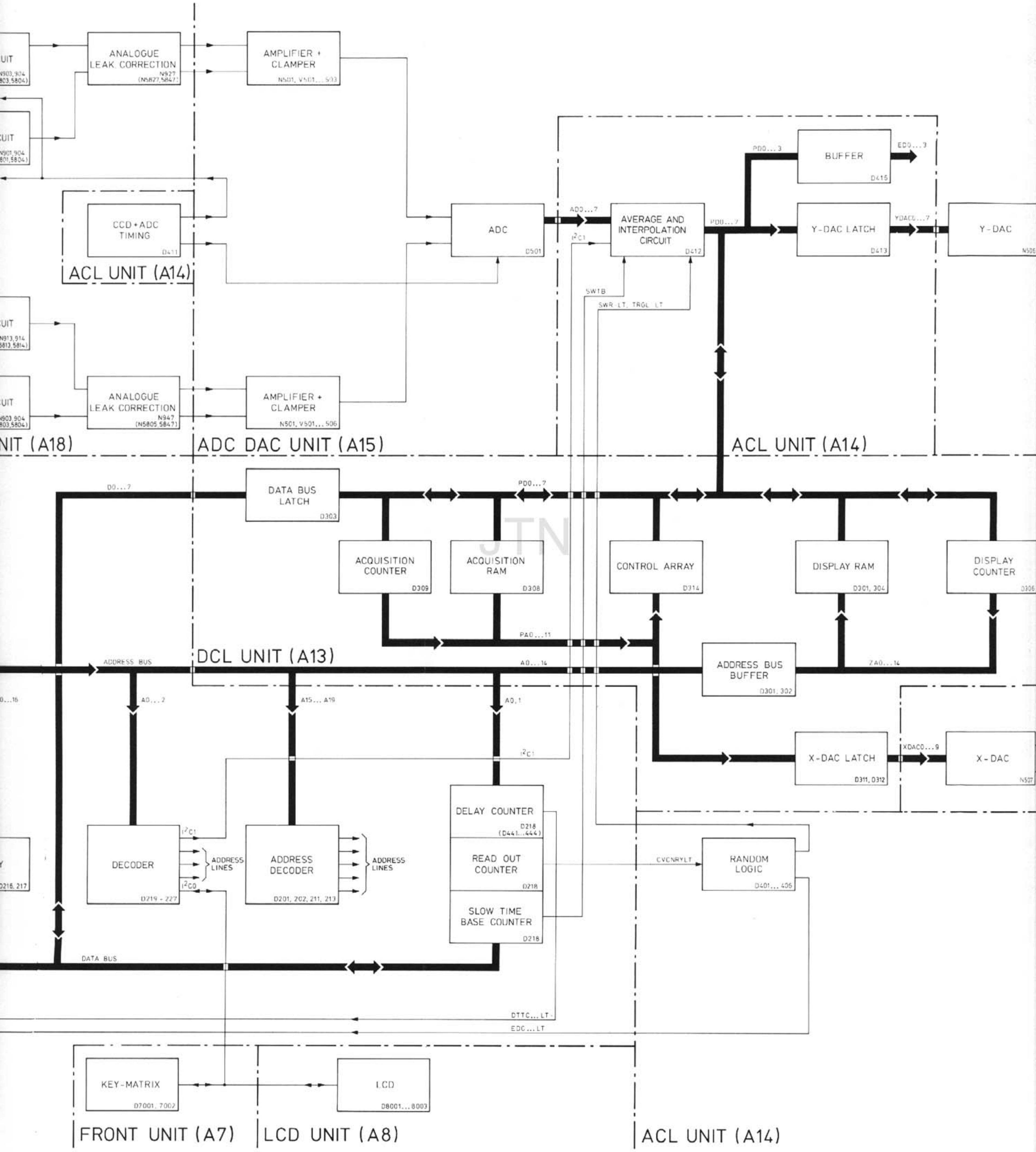
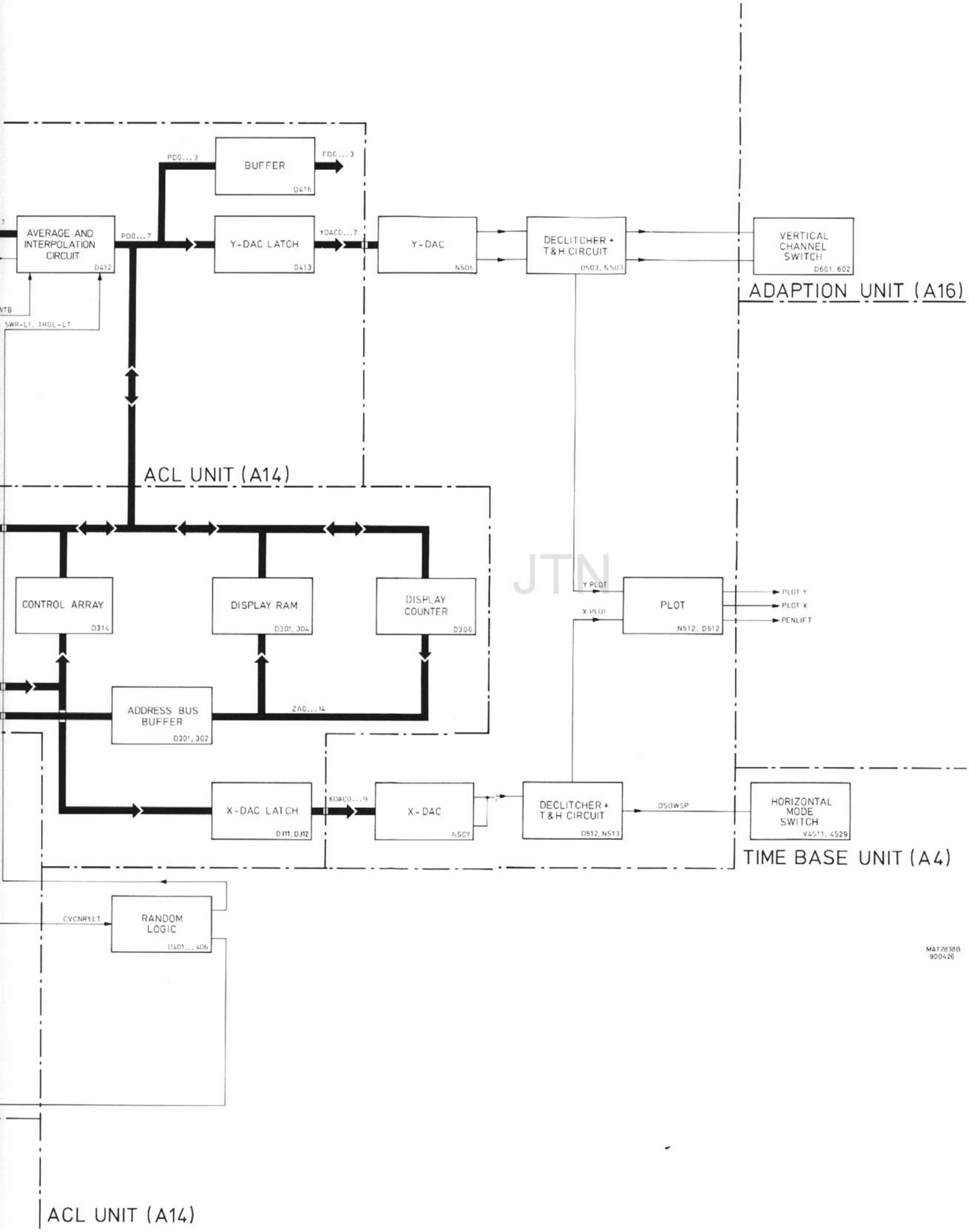


Figure 3.2 Block diagram, digital part


ANALOGUE LEAK CORRECTION
N927 (N5827,5847)
AMPLIFIER + CLAMPER
N501, V501...503
CCD+ADC TIMING
D411
ACL UNIT (A14)
ADC
D501
AD0...7
AVERAGE AND INTERPOLATION CIRCUIT
D412
PD0...7
PD0...3
BUFFER
D415
ED0...3
Y-DAC LATCH
D413
YDAC0...7
Y-DAC
SWTB
SWR LT, TRGL LT
ANALOGUE LEAK CORRECTION
N947 (N5805,5847)
AMPLIFIER + CLAMPER
N501, V501...506
ADC DAC UNIT (A15)
ACL UNIT (A14)
D0...7
DATA BUS LATCH
D303
PD0...7
ACQUISITION COUNTER
D309
ACQUISITION RAM
D308
CONTROL ARRAY
D314
DISPLAY RAM
D301, 304
DISPLAY COUNTER
PA0...11
ADDRESS BUS
DCL UNIT (A13)
A0...14
ADDRESS BUS BUFFER
D301, 302
ZA0...14
A0...2
A15...A19
A0,1
X-DAC LATCH
D311, D312
XDAC0...9
X-DAC
N507
DECODER
D219 - 227
ADDRESS LINES
ADDRESS DECODER
D201, 202, 211, 213
ADDRESS LINES
DELAY COUNTER
D218 (D441...444)
READ OUT COUNTER
D218
SLOW TIME BASE COUNTER
D218
CVCNRYLT
RANDOM LOGIC
D401...406
DATA BUS
DTTC...LT
EDC...LT
KEY-MATRIX
D7001, 7002
LCD
D8001...8003
FRONT UNIT (A7)
LCD UNIT (A8)
ACL UNIT (A14)



AVERAGE AND INTERPOLATION CIRCUIT
D412
PD0...7
PD0...3
BUFFER
D416
FD0...3
Y-DAC LATCH
D413
YDAC0...7
Y-DAC
N506
DEGLITCHER + T&H CIRCUIT
VERTICAL CHANNEL SWITCH
D601, 602
ADAPTION UNIT (A16)
SWR-LT, TRGL-LT
ACL UNIT (A14)
CONTROL ARRAY
D314
DISPLAY RAM
D301, 304
DISPLAY COUNTER
D306
ADDRESS BUS BUFFER
D301, 302
ZA0...14
Y PLOT
X PLOT
PLOT
N512, D512
PLOT Y
PLOT X
PENLIFT
X-DAC LATCH
D311, D312
XDAC0...9
X-DAC
N507
DEGLITCHER + T&H CIRCUIT
D512, N513
DSOWSP
HORIZONTAL MODE SWITCH
V4511, 4529
TIME BASE UNIT (A4)
CVCNRYLT
RANDOM LOGIC
D401...406
MAT2838B
900426
ACL UNIT (A14)

3.2.3 Pre-amplifier unit and adaptation unit (unit A2 and A16)

The pre-amplifier unit incorporates the signal splitters for the vertical channels A and B, the trigger level view amplifier, the trigger circuits for the time base and the chopper oscillator circuit. Next the adaptation unit is mounted as a separate p.c.b. on the pre-amplifier unit. All these functions are controlled by the CXYP and CXYA signals, generated by the X-Y CONTROL blocks.

*** Vertical channels A and B:**

Both channels are completely identical and receive their input signal from the ATTENUATOR UNIT. This signal is applied to the SIGNAL SPLITTER, which has two outputs:

- One output is applied to the SLOPE/TRIGGER SELECTION for the time base triggering.
- A second output is routed to the adaptation unit.

On the adaptation unit, vertical shift of the displayed signal is achieved by the front-panel POSITION control. Switching between the real time path and the digital storage path is obtained in the A/D SWITCH block. The digital circuit is given in figure 3.2 and described separately. Next, the output of the VERTICAL CHANNEL SWITCH is routed via the DELAY LINE DRIVER to the DELAY LINE.
The TRIGGER LEVEL VIEW channel enables display of the time base triggerlevel and can be used to determine the trigger point of the signal.

*** Trigger circuit:**

The SLOPE/TRIGGER SELECTION block receives a trigger signal from one of the vertical channels A or B, from both channels A and B (composite triggering), from the EXT SIGNAL SPLITTER or from the LINE TRIGGER PICK-OFF. Inverting of the trigger signal is controlled by the CXYA signals INVAM and INVBM to obtain the slope function. Routed via the TRIGGER PRE-AMPLIFIER block, the signal is split up into different paths:

- after summation of the TRIG LEVEL signal, direct to the TRIGGER AMPLIFIER
- to the AUTO LEVEL block. This block contains the different trigger facilities and levelling of the trigger signal is influenced by the front-panel TRIG LEVEL control. The output of this path is routed again to the summation point to influence the direct trigger signal.
- to the X-DEFL AMPLIFIER for X-deflection facility. This block incorporates a phase correction circuit for the X-Y display.

The TRIGGER AMPLIFIER feeds the trigger signal to the time-base unit. The trigger signal from the summation point is also routed via the TRIGGER LEVEL VIEW AMPLIFIER to the vertical CHANNEL SWITCH stage to display the trigger level.

*** Chopper oscillator circuit:**

A square-wave signal for chopper blanking and vertical switching is generated in the CHOP OSCILLATOR. For chopper blanking the signal is routed to the Z PRE-AMPLIFIER on the time-base unit.

3.2.4 Time-base unit (unit A4)

This unit incorporates the time-base (TB), the horizontal amplifier and the Z amplifier circuit. All functions are controlled by the CX1 and CX2 signals, generated by the HORIZONTAL CONTROL CIRCUIT blocks.

*** Time-base (TB):**

The trigger signal can be either directly routed to the TIME-BASE CONTROL CIRCUIT or first routed via the TV TRIGGER SELECTION for the TV trigger coupling. When in the AUTO mode, in the absence of trigger signals, the time base will be free running.

The TB CURRENT SOURCE applies the sawtooth charging current to the TB SWEEP CIRCUIT. This block generates the time base sawtooth signal, which is routed to the HORIZONTAL DISPLAY MODE SWITCH.

The HOLD OFF and the ALT CLOCK PULSE blocks are also under control of the TIME BASE CONTROL CIRCUIT. Hold off time is varied by the front-panel HOLD OFF control. The output of the HOLD OFF block is routed to the TIME-BASE CONTROL CIRCUIT again.

The ALTCLN-pulse, the output of the ALT CLOCK PULSE block, is applied to the PRE-AMPLIFIER UNIT.

3.2.5 XYZ unit (unit A3)

This unit comprises the final amplifiers for the vertical (Y) and horizontal (X) deflection and for the blanking (Z) circuit. In addition to this, the CRT control circuits are also incorporated in this unit.

*** Final vertical amplifier:**

The output signal from the pre-amplifier unit is first routed via the DELAY LINE to give sufficient delay to ensure that the steep leading edges of fast signals are displayed. The signal is then fed to the DELAY LINE COMPENSATION. This block compensates the signal fordistortion, originating from the DELAY LINE before it is applied to the FINAL VERTICAL AMPLIFIER. The output of the FINAL VERTICAL AMPLIFIER feeds the vertical deflection plates of the CRT.

*** Final horizontal amplifier:**

The horizontal deflection signal is routed to the FINAL HORIZONTAL AMPLIFIER, the output of which feeds the horizontal deflection plates of the CRT.

*** Blanking circuit:**

The output signal from the Z PRE-AMPLIFIER of the time-base unit, that determines trace blanking or unblanking and modulation, is routed to the FINAL Z-AMPLIFIER. After amplification, the blanking signal is split into two paths:

- the h.f. signals are fed via a high voltage capacitor to grid G1 of the CRT.
- the l.f. signals are used to modulate the amplitude of an oscillator wave-form, which then passes via another high voltage capacitor and is demodulated in the DEMODULATOR block to retrieve the original signal.

Note that the original h.f. and l.f. signals are again recombined on the grid G1.

*** CRT control circuits:**

The FOCUS AMPLIFIER block is influenced by both front-panel FOCUS and INTENS controls to provide a focus that is independent of the intensity, and drives the focusing grid G3 of the CRT.

The BLACK LEVEL block provides the correct presetting (- 100 V) of the cathode voltage.

The CRT BIAS circuit gives a d.c. voltage to the grids G4 and G5 to provide an optional adjustment for geometry and astigmatism.

3.2.6 Power supply unit (unit A6)

The mains input voltage is filtered and then applied to the RECTIFIER block to obtain a d.c. voltage source. Another output of the LINE FILTER block is routed via the LINE TRIGGER PICK-OFF and serves as a TB LINE trigger signal. The rectified mains source is routed to the FLYBACK CONVERTER, which generates the necessary voltages for the oscilloscope circuits. Each supply voltage is rectified in the RECTIFIERS block.
The LOW-voltage supplies are stabilized by the CONTROL circuit to the converter.
The +10 V REF supply serves as a low-voltage reference and is generated in the +10 V REFERENCE source block. This reference voltage is also fed to the different circuits on the power supply or in the oscilloscope.

The EHT CONVERTER generates the -14 kV for the post-accelerator anode of the CRT and the -2 kV for the cathode circuits.

*** Auxiliary circuits:**

The CALIBRATION GENERATOR generates the CAL voltage, which is applied to the output socket X1. The CAL voltage has a square-wave of 1,2 V p-p level with a frequency of 2 kHz.

The ILLUMINATION CIRCUIT determines the amount of current passed to the graticule illumination lamp of the CRT, controlled by the ILLUM control on the front-panel.

The TRACE ROTATION CIRCUIT determines the strength and sense of the current passed to the trace rotation coil around the neck of the CRT. The current is influenced by the front-panel screwdriver-operated TRACE ROT control.

3.2.7 P^2CCD circuits and control logic (unit A17 and A18)

In the PM3350A, the P^2CCD unit (Profiled Peristaltic Charged Coupled Device) incorporates two mini CCD units (one for each channel), the P^2CCD driver circuits and the P^2CCD output circuits. The two mini CCD units are mounted as separate units on the main board.
In the PM3355 the two P^2CCDs are situated on the main P2CCD unit A18.

The vertical channels A and B for the signals to be displayed are identical. Each channel comprises an INPUT BUFFER, P^2CCD, odd and even CIH (Clamp Integrate Hold) circuit and the ANALOGLEAKAGE CORRECTION.

Signals derived from the A/D switch on the adaptation unit are passing the P^2CCD circuits. These P^2CCDs act as analog shift registers which are able to store signal samples in a rhythm that depends on the selected time base speed. This rhythm is generated by the ACE (Advanced Customised ECL) and via the CLOCK DRIVERS applied to the P^2CCDs . For time-base speeds which cannot be handled by the ADC any more, the P^2CCD devices are used for time conversions. This means that signal samples can be sampled by the P^2CCDs in a high rhythm and later converted by an ADC circuit in a lower rhythm. This lower rhythm is generated by the READ OUT COUNTER. Each channel contains a P^2CCD which, in its turn, contains two sections of 256 signal samples.

The P^2CCD is fully controlled by the ACE, which delivers control signals and which also controls the CLOCK DRIVERS.

The outputs of the P^2CCDs are applied to fast CIH circuits. These circuits are able to hold the signal information for a time that is long enough for the track-and-hold circuit to take it over. The CIH circuits are controlled by the CCD and ADC TIMING.

The ANALOG LEAKAGE CORRECTION corrects the signals for leakage.

3.2.8 ADC circuit (unit A15)

The signal derived from the P^2CCD unit must first be clamped into the correct input signal for the ADC. This ADC converts the signal to an 8-bit digital word and is able to perform conversion at a maximum speed of 50 kHz. This conversion is controlled by the CCD+ADC TIMING.

3.2.9 Signal processing unit (unit A13 and A14)

The signal processing circuit consists of an AVERAGE AND INTERPOLATION circuit, an ACQUISITION circuit and a DISPLAY circuit. It takes data from the ADC, performs calculation on it and sends the data to the Y-DAC latch or it reads/writes the data from/to the microprocessor. The address of the data is put into the X-DAC latch.

The AVERAGE AND INTERPOLATION circuit averages the differences between the odd and even channels and calculates also 512 linear interpolated points between each of the 512 samples. The output data is transferred to the Y-DAC latch or to the memories.

During time intervals of 500 ns each, the different data transports occur in the following sequence:

- data is written in the ACQUISITION MEMORY, addressed by the ACQUISITION COUNTER.
- data is copied to the bidirectional latch in the CONTROL ARRAY.
- data is written in the DISPLAY MEMORY, addressed by the DISPLAY COUNTER.
- data is written in the Y-DAC LATCH.

Finally, during the last time interval the microprocessor is connected to the DISPLAY RAM via the DATA BUS LATCH and ADDRESS BUS BUFFER. The data from the microprocessor can influence several functions such as text, plot, dots, etc.

3.2.10 Y-DAC and X-DAC circuits (unit A15)

The Y-DAC and X-DAC convert the 8-bit data and 13-bit address information into analog signals again. Glitches on the output of both DACs are removed by the DEGLITCHER-circuits. Next the signals are fed via a TRACK&HOLD circuit, dot-join circuit, VERTICAL CHANNEL SWITCH or HORIZONTAL MODE SWITCH to the analogue circuits.

3.2.11 Microprocessor system (unit A12)

The microprocessor system mainly consists of a powerful 68008 μP, a RAM for data and a ROM containing the system software. The microprocessor is running at a frequency of 8 MHz provided by a CLOCK GENERATOR. This generator in its turn is driven by a 16 MHz crystal oscillator.

DECODERS decode a number of addresses resulting in the various address lines that are fed to the different circuits. Also the I^2C busses are decoded.

A WATCHDOG/RESET circuit detects abnormal program sequences via an output port and resets the microprocessor via the RESET and HALT lines in order to restart the program again.

The STATUS input reads the different status information of the instrument for the microprocessor.

4 ATTENUATOR UNIT (A1)

4.1 VERTICAL ATTENUATORS

The A and B channel attenuators are identical: therefore only channel is described.

All relay and FET switches are controlled by the microprocessor via the I^2C bus. The TEA 1017 converts this serial DATA into the parallel control signals for all relay or FET switches. A list of the control lines for all attenuator settings is given in the table below.

	X1H	X10H	X100H	X1F	X10F	X100F	X1L	X2,5L	X5L	X1/X10
2mV	●			●			●			●
5mV	●			●				●		●
10mV	●			●					●	●
20mV	●			●			●			
50mV	●			●				●		
.1V	●			●					●	
.2V		●			●		●			
.5V		●			●			●		
1V		●			●				●	
2V			●			●	●			
5V			●			●		●		
10V			●			●			●	

MAT 2227

Figure 4.1 Table of attenuator settings
(L = low impedance relais, H = high impedance FET, F = input coupling relais)

The channel A attenuator consists of in five stages:

Input coupling, where depending on the relay K1001 position, the input signal can either be d.c.-coupled (relay activated) or a.c.- coupled (relay not activated).

High impedance attenuator with three attenuator stages for the x1, x10 and x100 attenuation. The l.f. part of each stage is split via a resistor divider and routed via N1001 and V1019 to the output of this stage, where it is re-connected with the h.f. part of the input signal. Potentiometers R1036 (TRACE jump) serves as a offset compensation for N1001.

	RELAY	FET	TRIMMER FOR L.F. SQUARE WAVE	L.F. RESISTOR DIVIDER
x1	K1004	V1011	C1033	--
x10	K1003	V1006	C1029	R1007-R1011
x100	K1002	V1003	C1023	R1019-R1004

Note that, when "0" (GND-A) is selected, the output is connected to ground via FET V1016 and all other relay- and FET switches are switched off.

The **impedance converter** serves as an inverting buffer circuit for the high impedance attenuator. For the l.f.-feedback the output signal of this stage is routed to the l.f. summation point N1001-2.

The **low impedance attenuator** reduces the gain by x1, x2.5 and x5, depending on which relay is activated.

	RELAY	RESISTOR DIVIDER
x1	K1006	--
x2.5	K1007	R1053 vs R1056, R1057 and R1058
x5	K1008	R1053, R1056 and R1057 vs R1058

The **continuous circuit (OQ0203)**, the differential input voltages of which are fed to pins 4 and 5.
This stage comprises the following functions:

- Continuously variable control (pin 11).
- Gain x1 (pin 2 and 3) with offset adjustment R1064 (R1164) and gain adjustment R1069 (R1169).
- Gain x10 (pin 6 and 7) with offset adjusting R1072 (R1172) and gain adjustment R1076 (R1176).
- x1/x10 control to select the 2,5 and 10 mV/DIV settings.

The differential output current from pin 13 and pin 14 is routed via a common-base circuit V1063, V1064 and applied to the pre-amplifier unit.

4.2 EXTERNAL INPUT

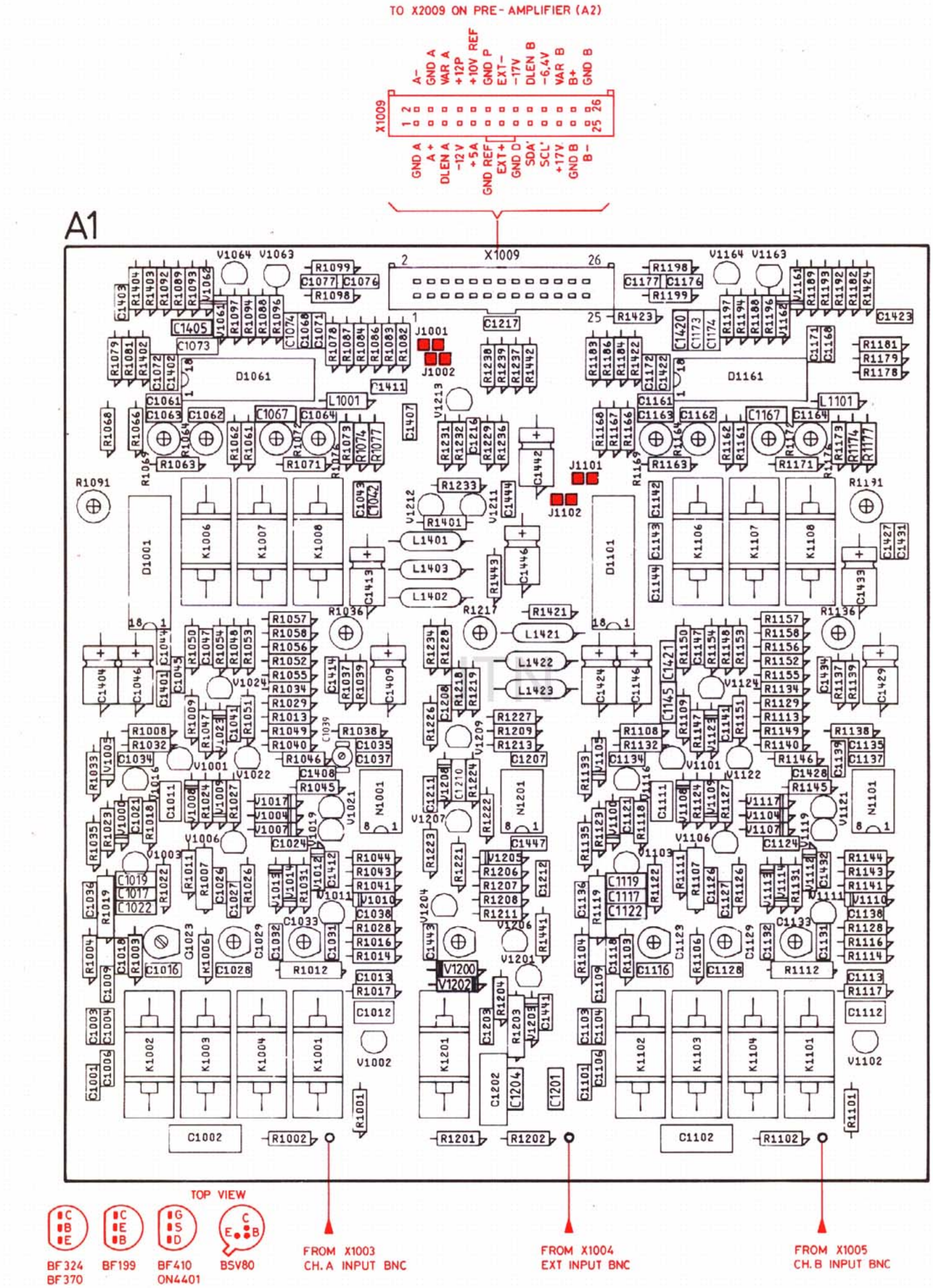
The external input can be subdivided into four stages:

Input coupling, basically similar to the ch.A input coupling.

High impedance attenuator for the x1 attenuator only, where the l.f. square-wave can be adjusted with trimmer C1206. The l.f. part is routed to the summation point N1201-2. R1217 serves as an offset compensation for N1201. For l.f.-feedback the output of the impedance converter is also routed to this summation point.
Note that the output of this stage is also a reconstituted version of the input signal.

Impedance converter, is basic similar to the ch.A impedance converter.

The **differential amplifier** V1211, V1212 converts the voltage from emitter-follower V1209 into the differential current signals EXT+ and EXT-. This signal is applied to the pre-amplifier unit and serves as external trigger signal or as an external deflection signal. The current for this stage is applied from current source V1213.



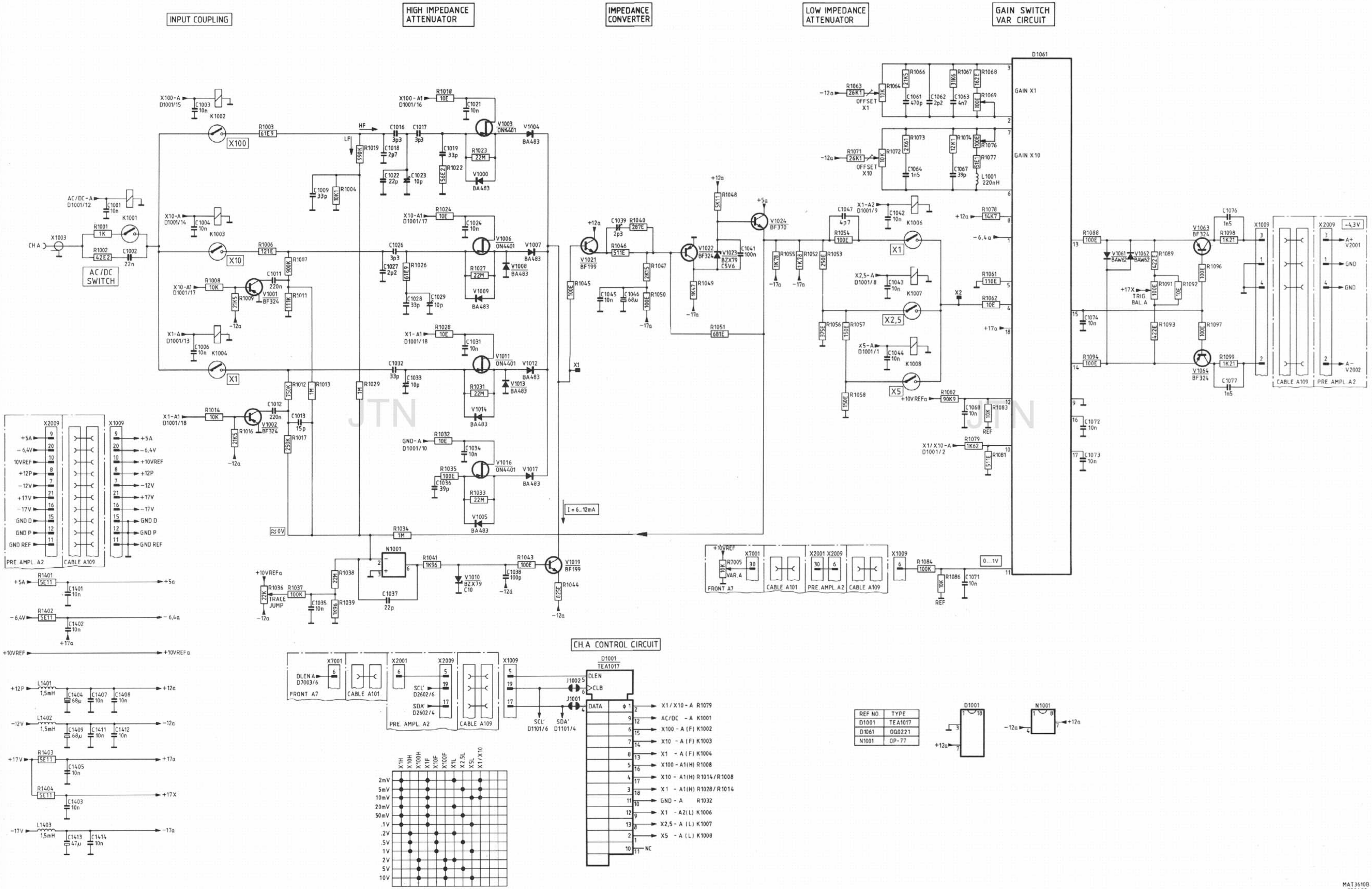
SOLDERJOINTS:

J1001	IF OPENED, SDA' TO D1061 IS INTERRUPTED
J1002	IF OPENED, SCA' TO D1061 IS INTERRUPTED
J1003	IF OPENED, SDA' TO D1161 IS INTERRUPTED
J1004	IF OPENED, SCA' TO D1161 IS INTERRUPTED

TO BE USED IN POWER-UP ROUTINE IN CASE OF FAILURE

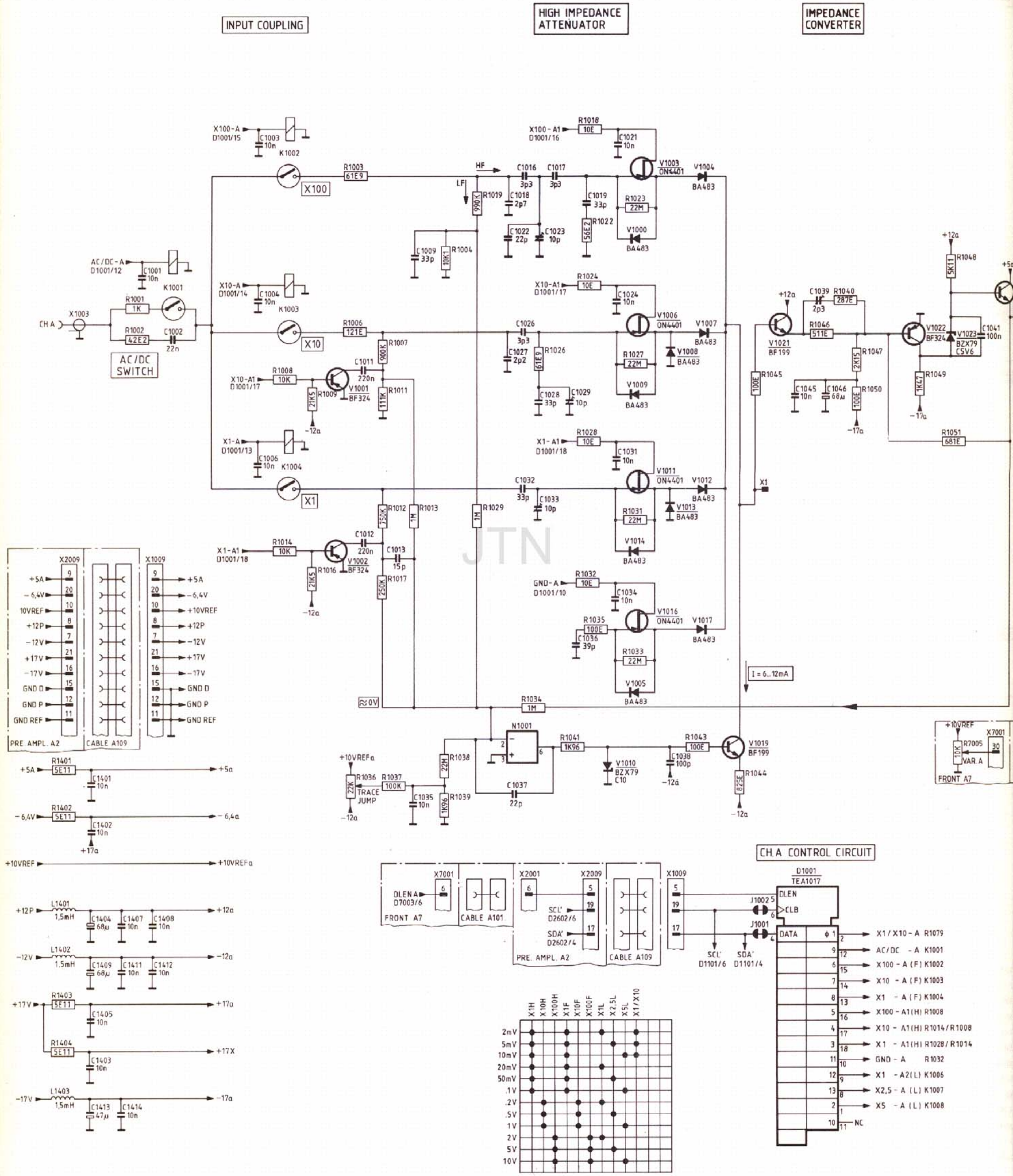
MAT3609A

Figure 4.2 Attenuator unit pcb

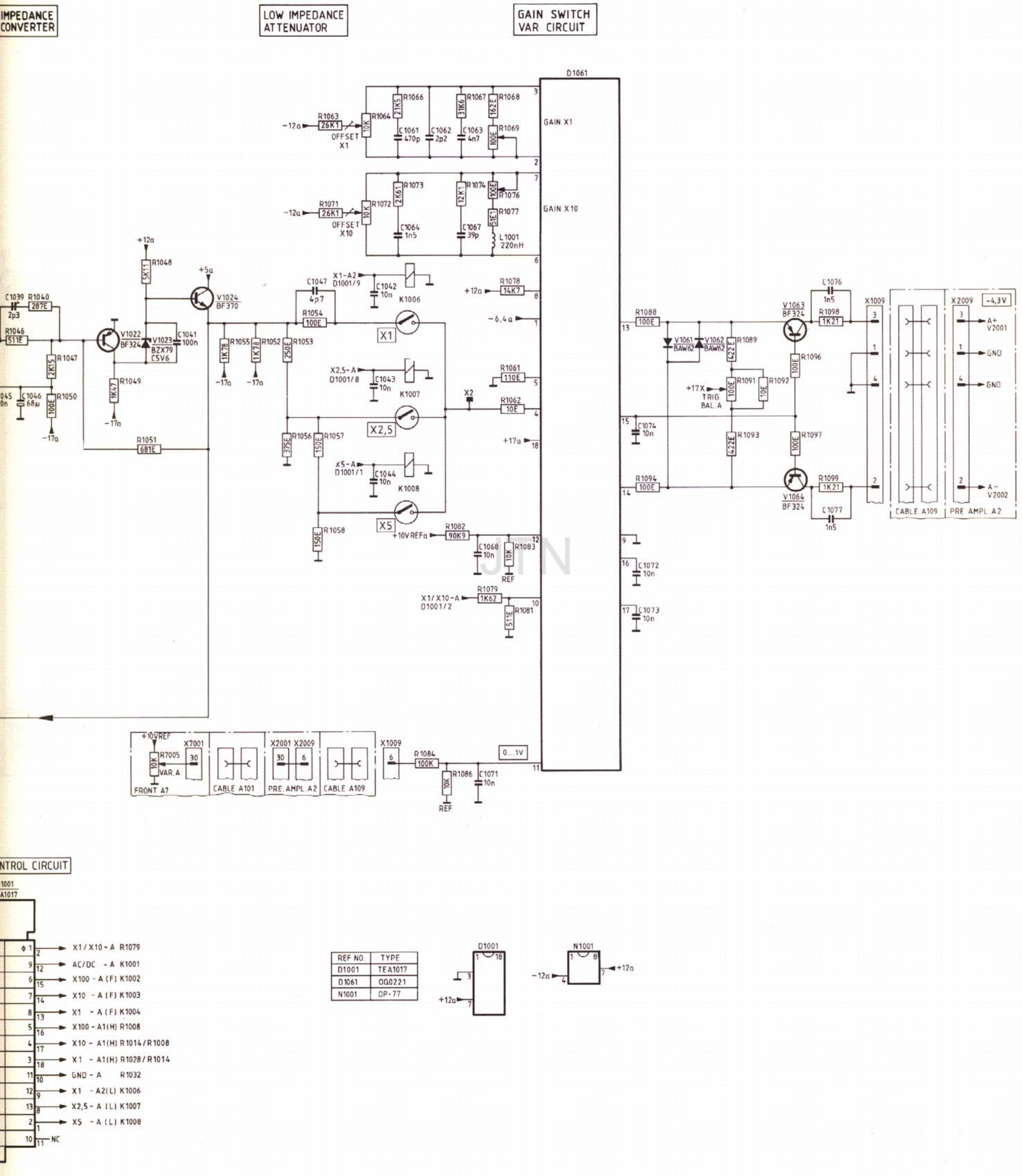


REF NO.	TYPE
D1001	TEA1017
D1061	OQ0221
N1001	OP-77

Figure 4.3 Circuit diagram of attenuator: ch. A



INPUT COUPLING
HIGH IMPEDANCE ATTENUATOR
IMPEDANCE CONVERTER
CH A
X1003
AC/DC SWITCH
K1001
R1001 1K
R1002 42E2
C1002 22n
AC/DC-A D1001/12
C1001 10n
X100-A D1001/15
C1003 10n
K1002
R1003 61E9
X100
X10-A D1001/14
C1004 10n
K1003
R1006 121E
X10
X1-A D1001/13
C1006 10n
K1004
X1
X10-A1 D1001/17
R1008 10K
V1001 BF324
R1009 21K5
C1011 220n
R1007 900K
R1011 111K
X1-A1 D1001/18
R1014 10K
V1002 BF324
R1016 21K5
C1012 220n
C1013 15p
R1012 750K
R1013 1M
R1017 250K
HF
LF
R1019 990K
R1004 10K1
C1009 33p
C1016 3p3
C1017 3p3
C1018 2p7
C1022 22p
C1023 10p
C1019 33p
R1022 56E2
X100-A1 D1001/16
R1018 10E
C1021 10n
V1003 ON4401
V1004 BA483
R1023 22M
V1000 BA483
X10-A1 D1001/17
R1024 10E
C1024 10n
C1026 3p3
C1027 2p2
R1026 61E9
C1028 33p
C1029 10p
V1006 ON4401
V1007 BA483
V1008 BA483
R1027 22M
V1009 BA483
X1-A1 D1001/18
R1028 10E
C1031 10n
C1032 33p
C1033 10p
V1011 ON4401
V1012 BA483
V1013 BA483
R1031 22M
V1014 BA483
R1029 1M
GND-A D1001/10
R1032 10E
C1034 10n
R1035 100E
C1036 39p
V1016 ON4401
V1017 BA483
R1033 22M
V1005 BA483
≈0V
R1034 1M
I = 6...12mA
X1
R1045 100E
+12a
V1021 BF199
C1039 2p3
R1040 287E
R1046 511E
R1047 2K15
C1045 10n
C1046 68µ
R1050 100E
-17a
V1022 BF324
V1023 BZX79 C5V6
C1041 100n
R1049 1K47
R1048 5K11
R1051 681E
N1001
R1041 1K96
V1010 BZX79 C10
R1043 100E
C1038 100p
-12a
V1019 BF199
R1044 825E
C1037 22p
R1038 22M
R1039 1K96
C1035 10n
R1037 100K
R1036 22K TRACE JUMP
+10VREFa
+10VREF
R7005 10K VAR. A
X7001 30
FRONT A7
X2009
X1009
+5A
-6,4V
10VREF
+12P
-12V
+17V
-17V
GND D
GND P
GND REF
PRE. AMPL. A2
CABLE A109
R1401 5E11
C1401 10n
+5a
R1402 5E11
C1402 10n
-6,4a
+10VREFa
L1401 1,5mH
C1404 68µ
C1407 10n
C1408 10n
+12a
L1402 1,5mH
C1409 68µ
C1411 10n
C1412 10n
-12a
R1403 5E11
C1405 10n
+17a
R1404 5E11
C1403 10n
+17X
L1403 1,5mH
C1413 47µ
C1414 10n
-17a
CH A CONTROL CIRCUIT
D1001 TEA1017
DLEN A D7003/6
FRONT A7
CABLE A101
X2001
SCL' D2602/6
SDA' D2602/4
PRE. AMPL. A2
CABLE A109
J1002
J1001
DLEN
CLB
DATA
SCL' D1101/6
SDA' D1101/4
X1/X10-A R1079
AC/DC -A K1001
X100-A (F) K1002
X10 -A (F) K1003
X1 -A (F) K1004
X100-A1(H) R1008
X10 -A1(H) R1014/R1008
X1 -A1(H) R1028/R1014
GND-A R1032
X1 -A2(L) K1006
X2,5-A (L) K1007
X5 -A (L) K1008
NC
X1H X10H X100H X1F X10F X100F X1L X2,5L X5L X1/X10
2mV 5mV 10mV 20mV 50mV .1V .2V .5V 1V 2V 5V 10V



REF NO.	TYPE
D1001	TEA1017
D1061	OQ0221
N1001	OP-77

MAT3610B
900423

Figure 4.3 Circuit diagram of attenuator: ch. A

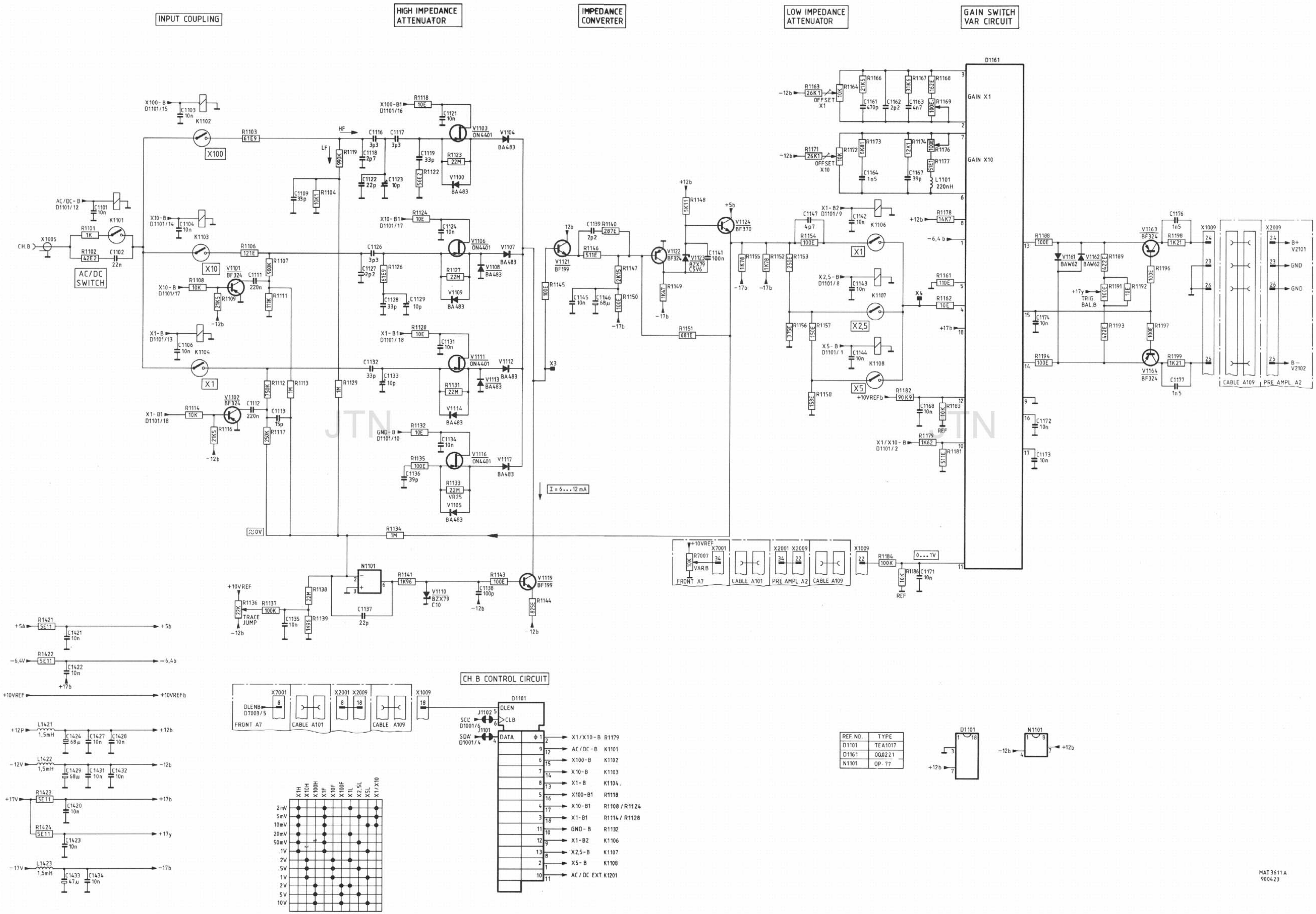


Figure 4.4 Circuit diagram of attenuator: ch. B

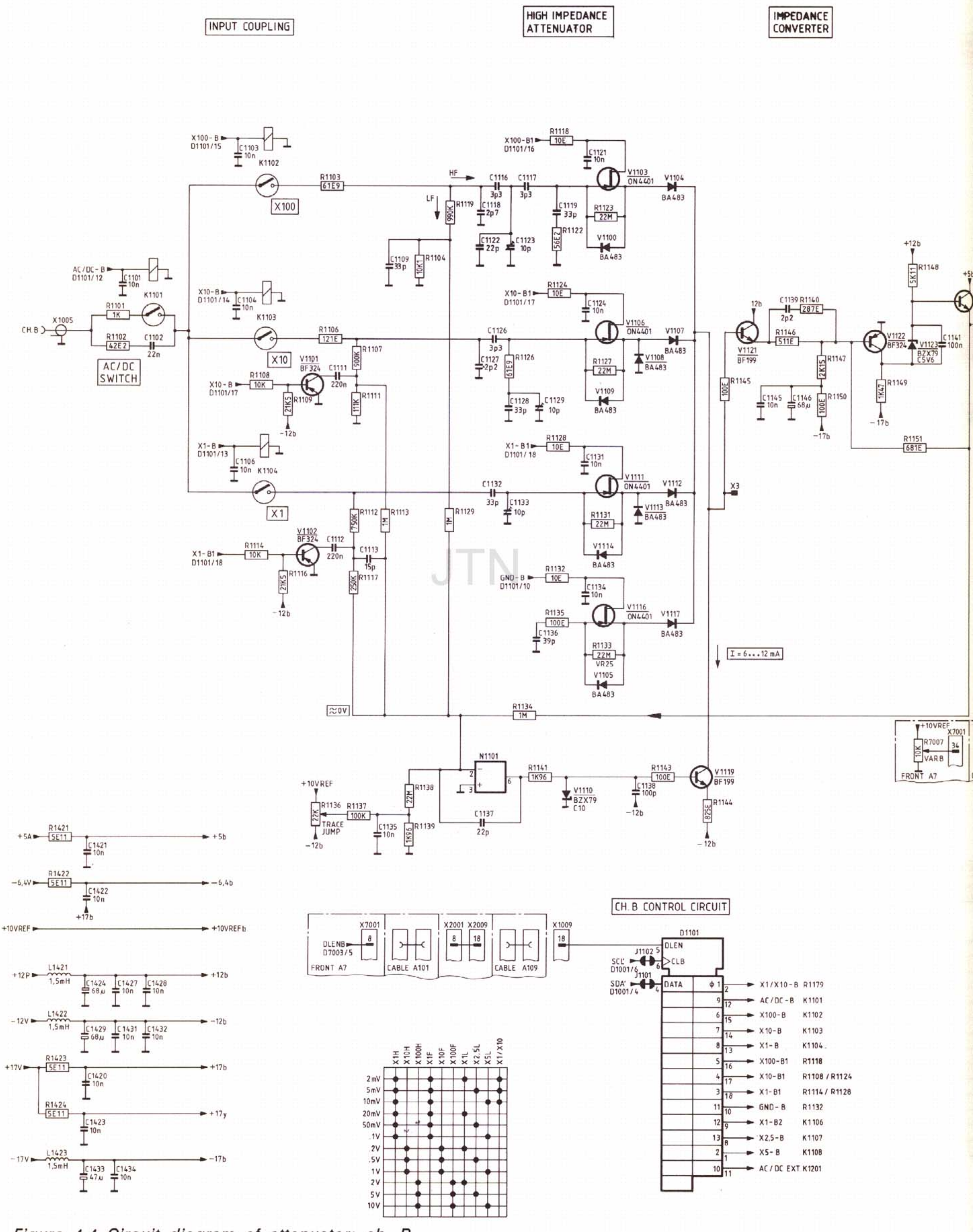
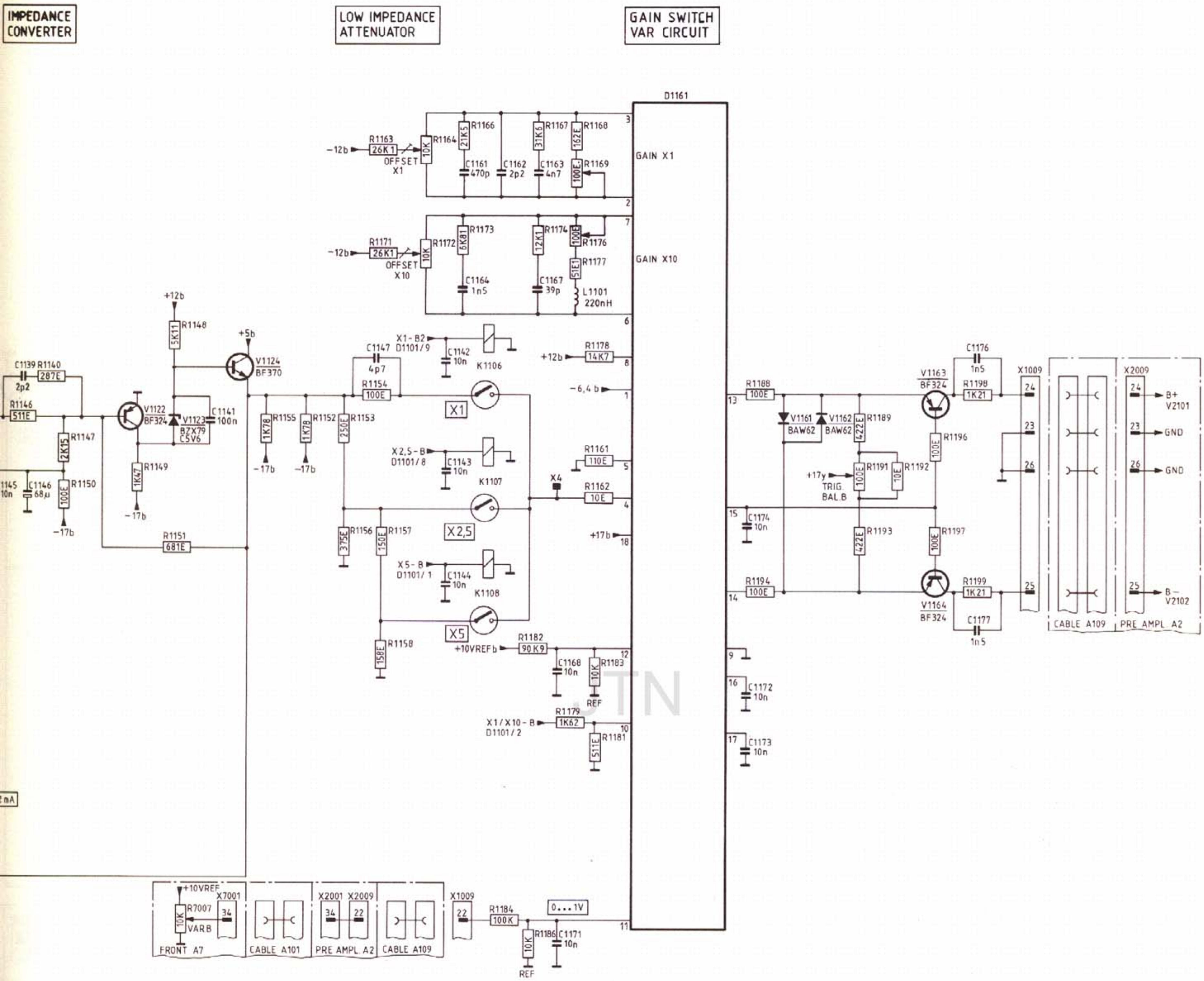
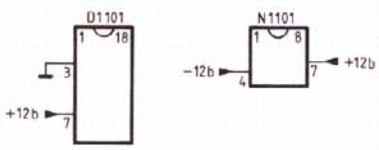


Figure 4.4 Circuit diagram of attenuator: ch. B

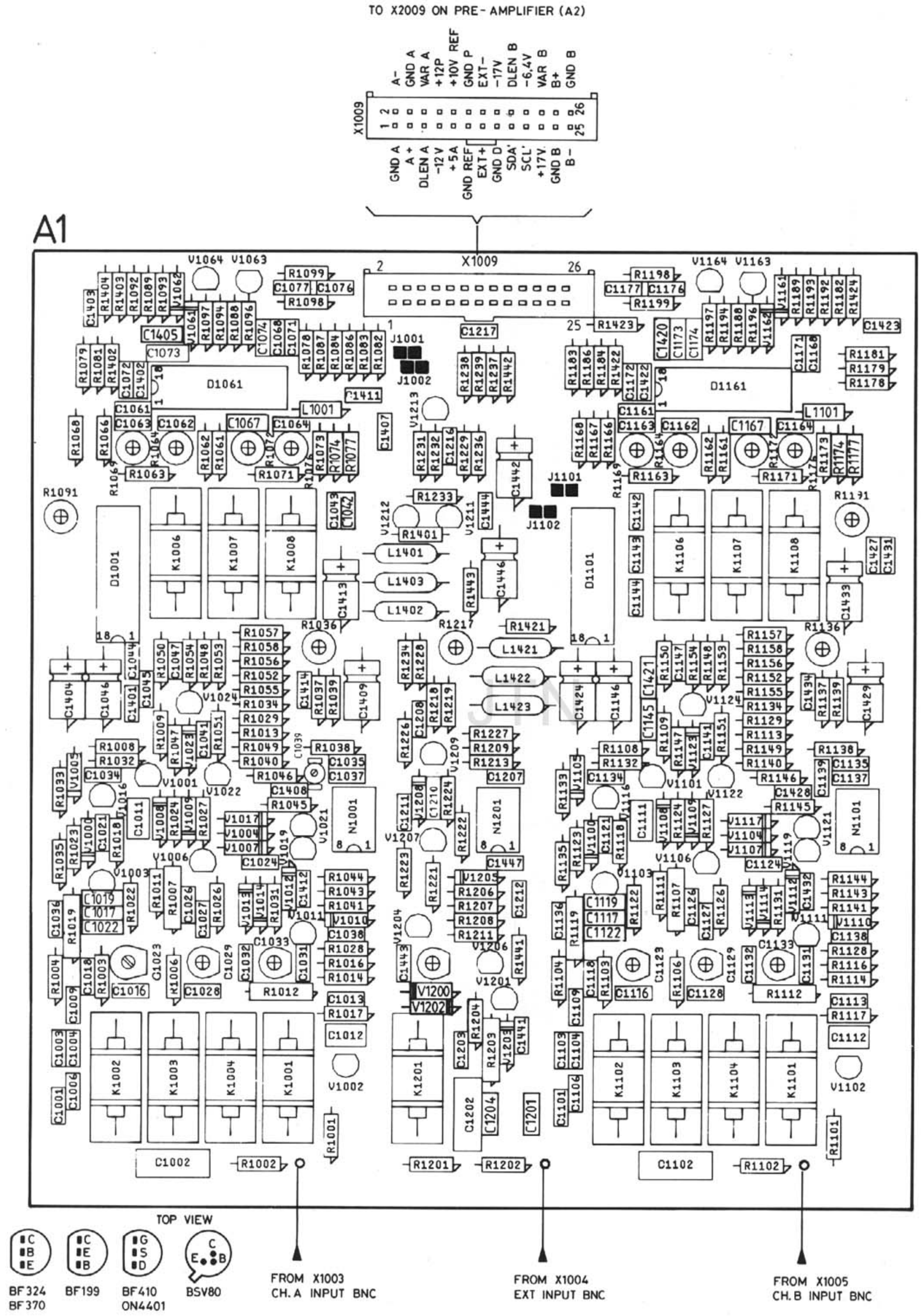


REF. NO.	TYPE
D1101	TEA1017
D1161	OQ0221
N1101	OP- 77



1/X10-B R1179
C/DC-B K1101
100-B K1102
10-B K1103
1-B K1104
100-B1 R1118
10-B1 R1108 / R1124
1-B1 R1114 / R1128
ND-B R1132
1-B2 K1106
2,5-B K1107
5-B K1108
C/DC EXT K1201

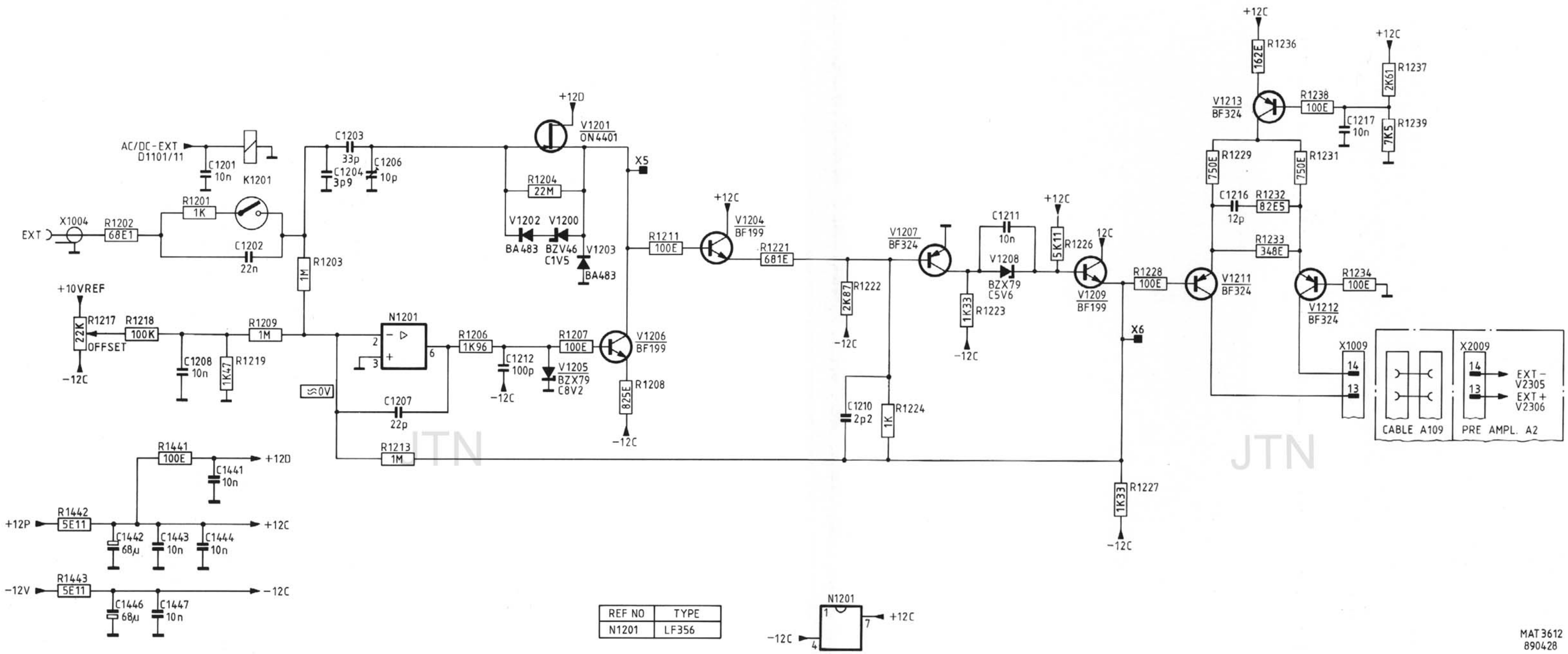
MAT 3611 A
900423



SOLDERJOINTS:	
J1001	IF OPENED, SDA' TO D1061 IS INTERRUPTED
J1002	IF OPENED, SCA' TO D1061 IS INTERRUPTED
J1003	IF OPENED, SDA' TO D1161 IS INTERRUPTED
J1004	IF OPENED, SCA' TO D1161 IS INTERRUPTED
TO BE USED IN POWER-UP ROUTINE IN CASE OF FAILURE	

Figure 4.5 Attenuator unit pcb

MAT3609A



REF NO	TYPE
N1201	LF356

Figure 4.6 Circuit diagram of attenuator: EXT

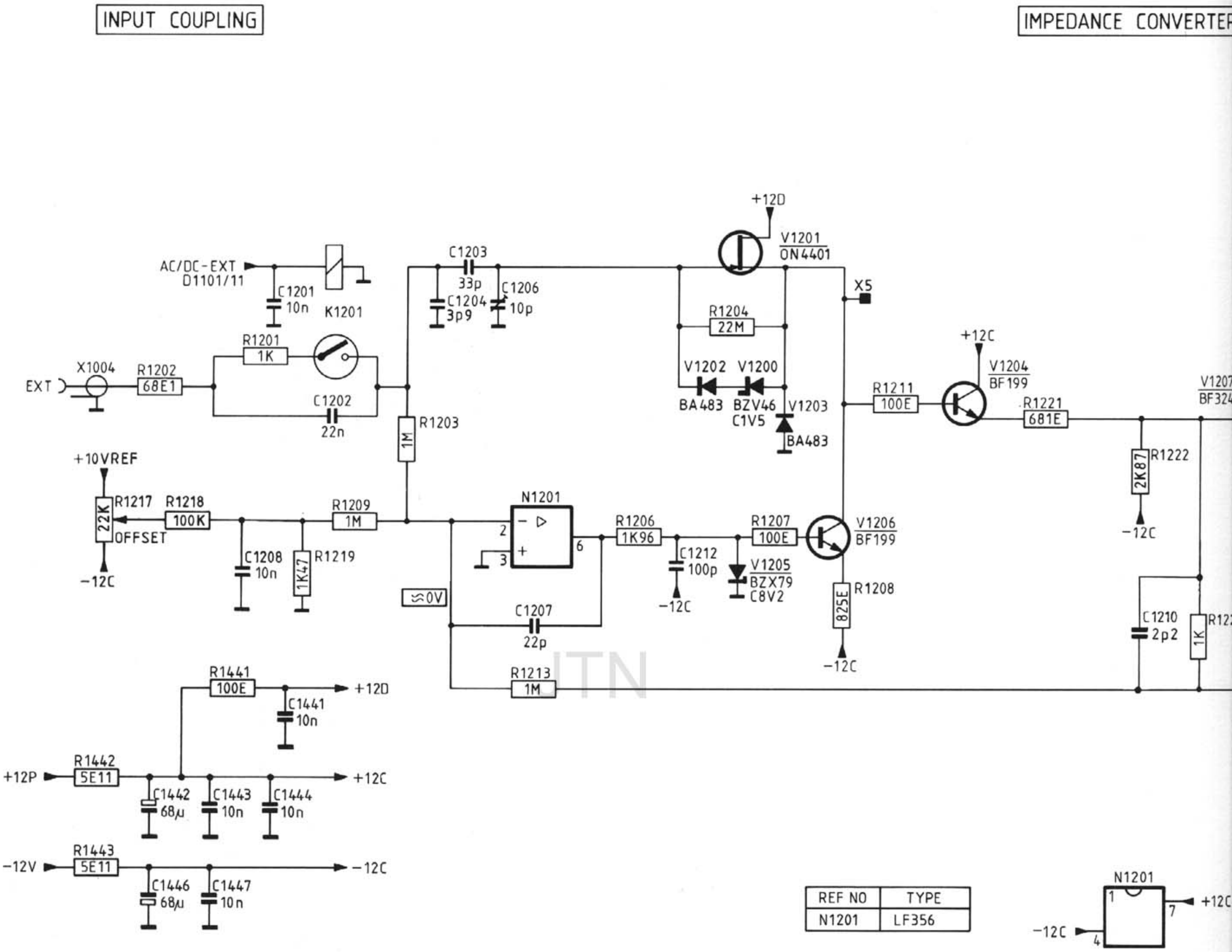
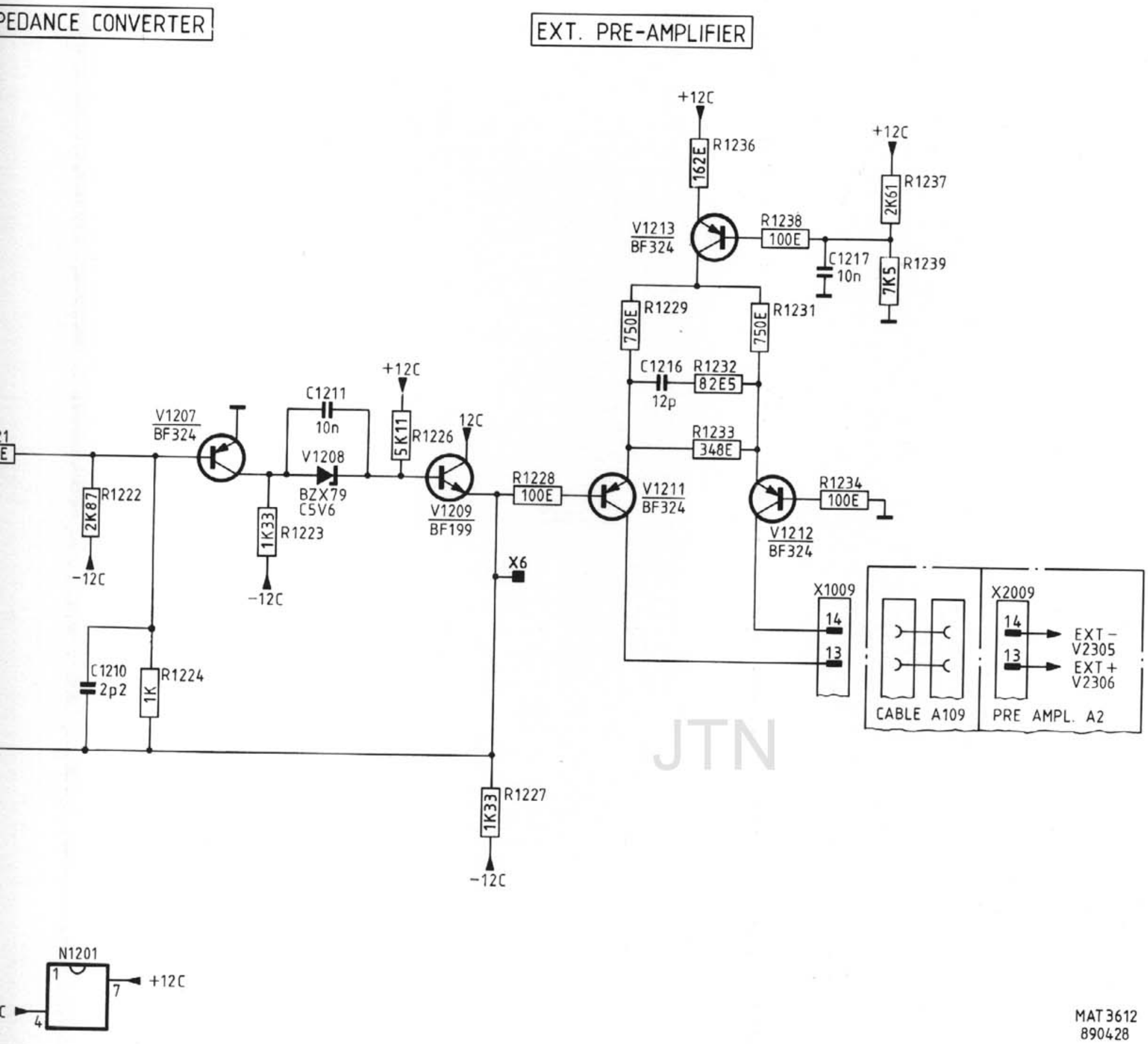


Figure 4.6 Circuit diagram of attenuator: EXT



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890428

5 PRE-AMPLIFIER UNIT (A2)

The pre-amplifier unit consists of:

- Vertical pre-amplifier
- Trigger pre-amplifier
- Pre-amplifier control, incl. CHOPPER oscillator

The adaptation unit A16 is also mounted on this board.
(This unit is described separately in chapter 17.)

All control pulses for this unit are generated by the pre-amplifier control circuit, via the I^2C bus (see Section 5.4).

5.1 VERTICAL PRE-AMPLIFIER

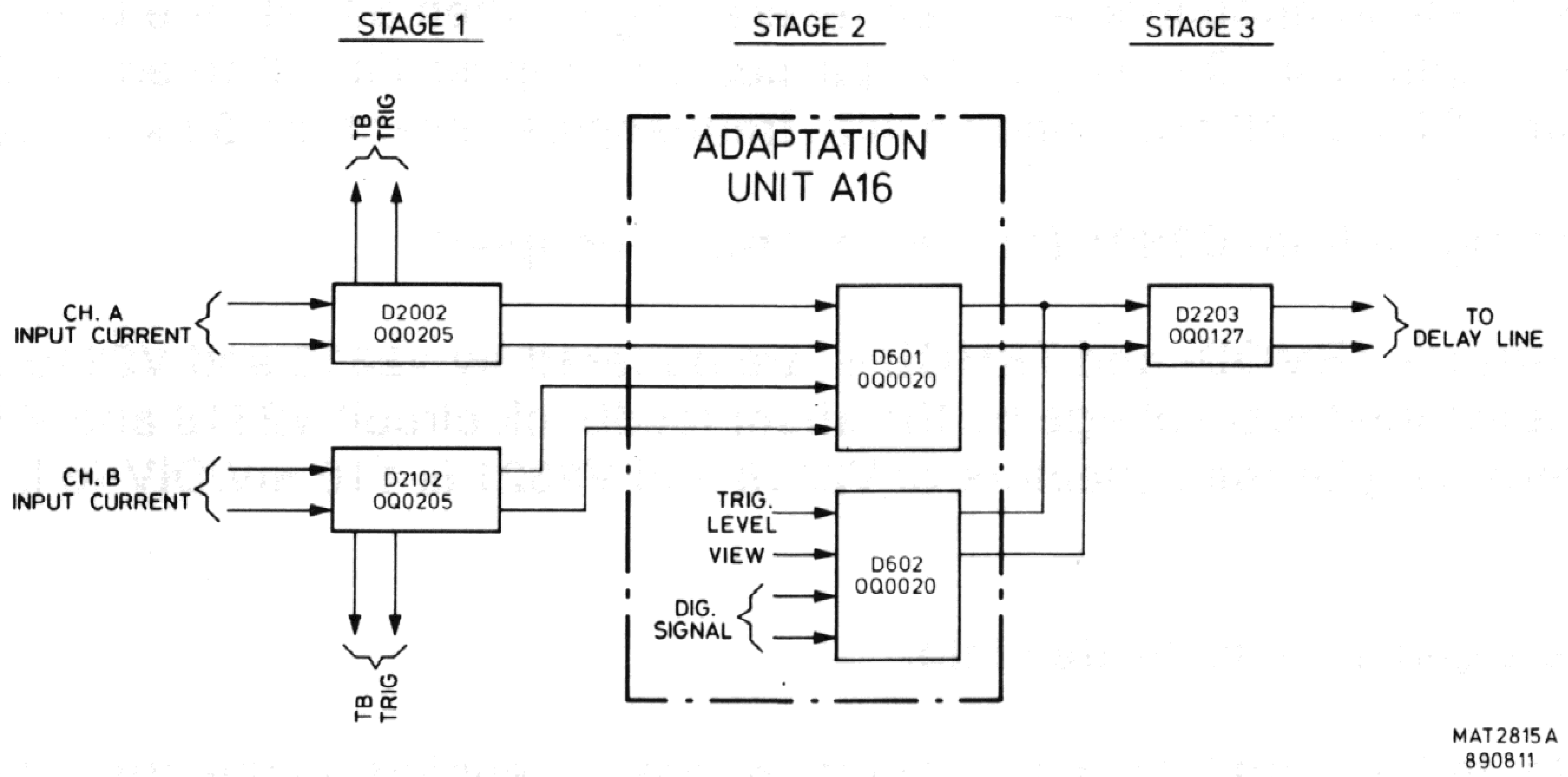


Figure 5.1 The three stages of the vertical pre-amplifier

The vertical pre-amplifier consists of three stages.

Stage 1: The signal splitter (OQ205) receives its input signal for channel A (B) from the attenuator unit and copies this signal into two identical differential output current signals for:

- Vertical channel (pin 7 and 10)
- TB triggering (pin 5 and 12), see section 5.2.

The output of pin 7 and 10 is applied to the adaptation unit A16.

Stage 2 (unit A16): see the description of A16.

Stage 3 (D2203) serves as delay line driver where the output current of both OQ0020s is converted into voltage signals applied to the delay line. The current for this stage and for D2201 and D2202 is fed via R2231 and R2246.
The current regulation for the common-mode circuit is achieved by transistor D2203 (12, 13, 14).

5.2 TB TRIGGER PRE-AMPLIFIER

Trigger possibilities are:

	Signal name	routed to	Selected by: name	routed to	Inverted by: name	routed to
ch. A	TRAM+, TRAM-	D2302(3,4)	AM	D2302(10)	INVAM	D2302(2)
ch. B	TRBM+, TRBM-	D2302(5,6)	BM	D2302(11)	INVBM	D2302(7)
EXT	EXT-, EXT+	D2303(3,4)	EXTM	D2303(10)	INVAM	D2303(2)
line	LINE	D2303(5)	LNM	D2303(11)	INVAM	D2303(7)

D2301 serves as a signal splitter and receives its input signal from the attenuator unit. This input current signals are copied into identical differential output current signals for EXT TB signal (pin 6 and 11).

The symmetrical output currents from D2302 (13, 14) and D2303 (13, 14) are buffered by V2801 and V2802 and then applied to the DC-LF-HF trigger circuit D2801. This device is controlled on pin 15 for LF, pin 10 for HF and pin 9 for DC trigger coupling. A +3,2 V to one of these three inputs selects one trigger coupling mode while the other inputs are then +1,9 V. D2802 Converts the data of the I^2C bus to these control lines.

In LF mode, the signal from D2801 (13, 16) passes a low-pass filter formed by C2801, R2809 and R2811. All components with frequencies higher then 50 kHz are then rejected.
In HF mode, the signal from D2801 (12, 17) passes a high-pass filter formed by C2802, C2803, R2811 and R2813. All components with frequencies lower then 50 kHz are now rejected.
In DC mode, the signal from D2801 (11, 18) is directly coupled.

The resulting currents TRMOD- and TRMOD+ are buffered by V2316 and V2319 and then converted into a symmetrical voltage by the shunt feedback circuit V2318 and V2321. Note that the sensitivity at the collectors of V2318 and V2321 is 110 mV/DIV (c.i. MTB- and MTB+).

At this point the signal path is divided into:

- a trigger path, fed to both V2333 and V2334, where depending on the current to the base, levelling of the trigger signal is obtained. Two separate series feedback circuits take care of voltage-to-current conversion:

  * V2341 and V2342 for time-base triggering.
    The trigger output signal, TRIGM- and TRIGM+ are fed to the time- base unit A4.
  * V2347 and V2349 for trigger level view.
    This symmetrical output can be balanced by potentiometer R2407.
    The TRIGV+ and TRIGV- signals are fed to the adaptation unit A16.

  Integrated circuit D2304 serves as an auto level circuit. The following functions are possible.

  a. Peak-peak
  In this case the amplitude of the trigger signal applied to D2304 (3,7) is measured by peak-peak detectors on D2304 (2,4,6,8). The output current from D2304 (14,15) is dependent on the peak-peak level and is adjustable with the TRIG LEVEL control R7012, connected to D2304(1).

b. Triggering
In this case the level range is 16 div. The trigger level is adjustable with R7012 and the current variation on D2304 (14,15) can be varied between +or- 0,6mA.

c. TV triggering
The level control is made ineffective. In TV triggering, the TRIG LEVEL must be set to a fixed value. This is done by applying a high level current to pin 1 via diode V2326.

d. Auto
In auto the signal LEVEL ZERO is high and via diode V2325 the outputlevel D2304 (15) is asymmetrical with output level D2304 (14). Thus the maximum signal amplitude is 2 Vp-p.

- an external deflection path, routed via the series feedback circuit V2356 and V2357, the X DEFL+ and X DEFL- signals are fed to the time base unit A2.
  R2416, R2422 and C2350 gives phase correction for the X-Y display.

5.3 PRE-AMPLIFIER CONTROL

The pre-amplifier control converts the data from the 1/2\C bus (SDA andSCL), derived from the microcomputer, into the control pulses for the pre-amplifier unit. To eliminate interference the SDA and SCL lines can be switched off via D2601.

This integrated circuit serves as a digital switch, controlled by the VERT IIC line. Logic high connects the outputs D2601(4,14,15) to the input "1" contact (switched on); logic low connects the outputs to the "2" contact (switched off) and gives SDA a logic low level and SCL a logic high level.

When D2601 is switched on, the serial data information is converted into parallel control pulses via D2602 and D2603, provided that D2602 is enabled (D2602-5 is high). The control lines are active when the level of the line is high.

Output Q12-D2602(9) serves as a power up not line for D2603: when the oscilloscope is in the power-up routine, Q12 is high and resets D2603. After the power-up routine, Q12 goes low and enables D2603.

Integrated circuit D2603 relieves the microcomputer of a number of such functions as:

- trigger level view
- chop/alt
- trigger select
- time-base select (fed to time base unit A4)

Adaptation of this I.C. to the oscilloscope version is made by the AD0 and AD1 inputs D2603(15,16).
For this oscilloscope, both AD0 and AD1 must be LOW.

Timing for alternate and chopped mode is derived by the ALTCLN and CHOPCL pulses.

The chopper oscillator formed by V2611 and V2612 supplies a square wave voltage of 1,5 Vp-p with a frequency of 1 MHz.

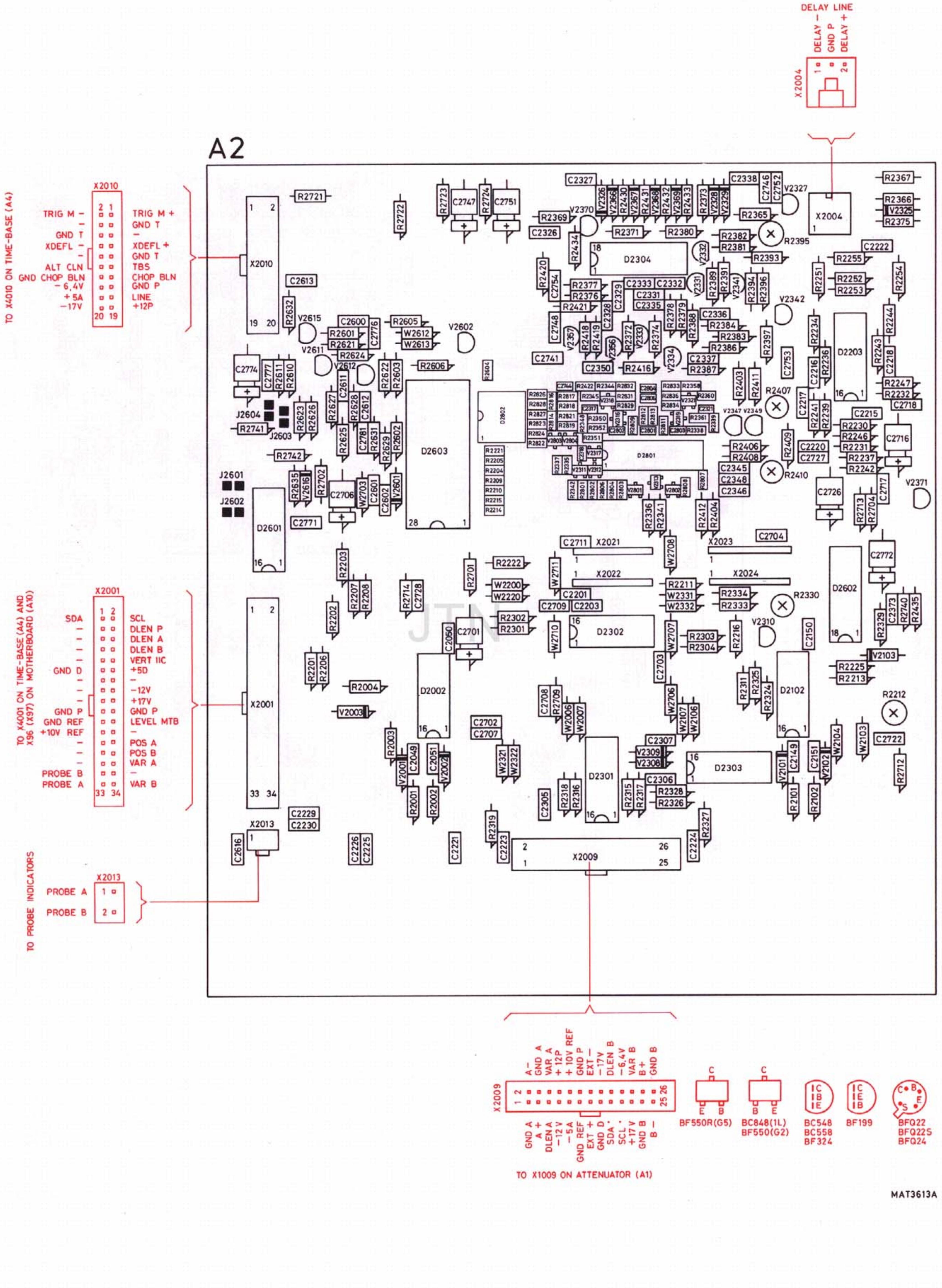
This frequency is defined by two current loops:

- I1 is determined by: V2612(c-e), C2611, R2627 and R2625.
- I2 is determined by: V2611(c-e), C2611, R2628 and R2625.

The duty cycle (I1/I1 + I2) is 12% approx.

The square wave on the collector of V2612 serves as a chopper clock pulse for D2603 and gives a 500 kHz display for 2 channels CHOP, 333 kHz display for 3 channels CHOP and 250 kHz for 4 channels CHOP
(A-B-TRIG VIEW-ADD).

Note that D2603(8) serves as the chopper switch, which is high when the CHOP softkey is depressed.



A2
DELAY LINE
DELAY −
GND P
DELAY +
X2004
X2010
TRIG M −
TRIG M +
GND T
XDEFL −
XDEFL +
ALT CLN
TBS
GND CHOP BLN
CHOP BLN
− 6,4V
GND P
+ 5A
LINE
−17V
+12P
TO X4010 ON TIME-BASE (A4)
X2001
SDA
SCL
DLEN P
DLEN A
DLEN B
VERT IIC
GND D
+5D
−12V
+17V
GND P
GND REF
LEVEL MTB
+10V REF
POS A
POS B
VAR A
PROBE B
PROBE A
VAR B
TO X4001 ON TIME-BASE (A4) AND X96 (X97) ON MOTHERBOARD (A10)
X2013
PROBE A
PROBE B
TO PROBE INDICATORS
X2009
A −
GND A
VAR A
+ 12P
+ 10V REF
GND P
EXT −
− 17V
DLEN B
− 6,4V
VAR B
B +
GND B
GND A
A +
DLEN A
− 12 V
− 5A
GND REF
EXT +
GND D
SDA
SCL
+17 V
GND B
B −
TO X1009 ON ATTENUATOR (A1)
BF550R(G5)
BC848(1L)
BF550(G2)
BC548
BC558
BF324
BF199
BFQ22
BFQ22S
BFQ24
MAT3613A

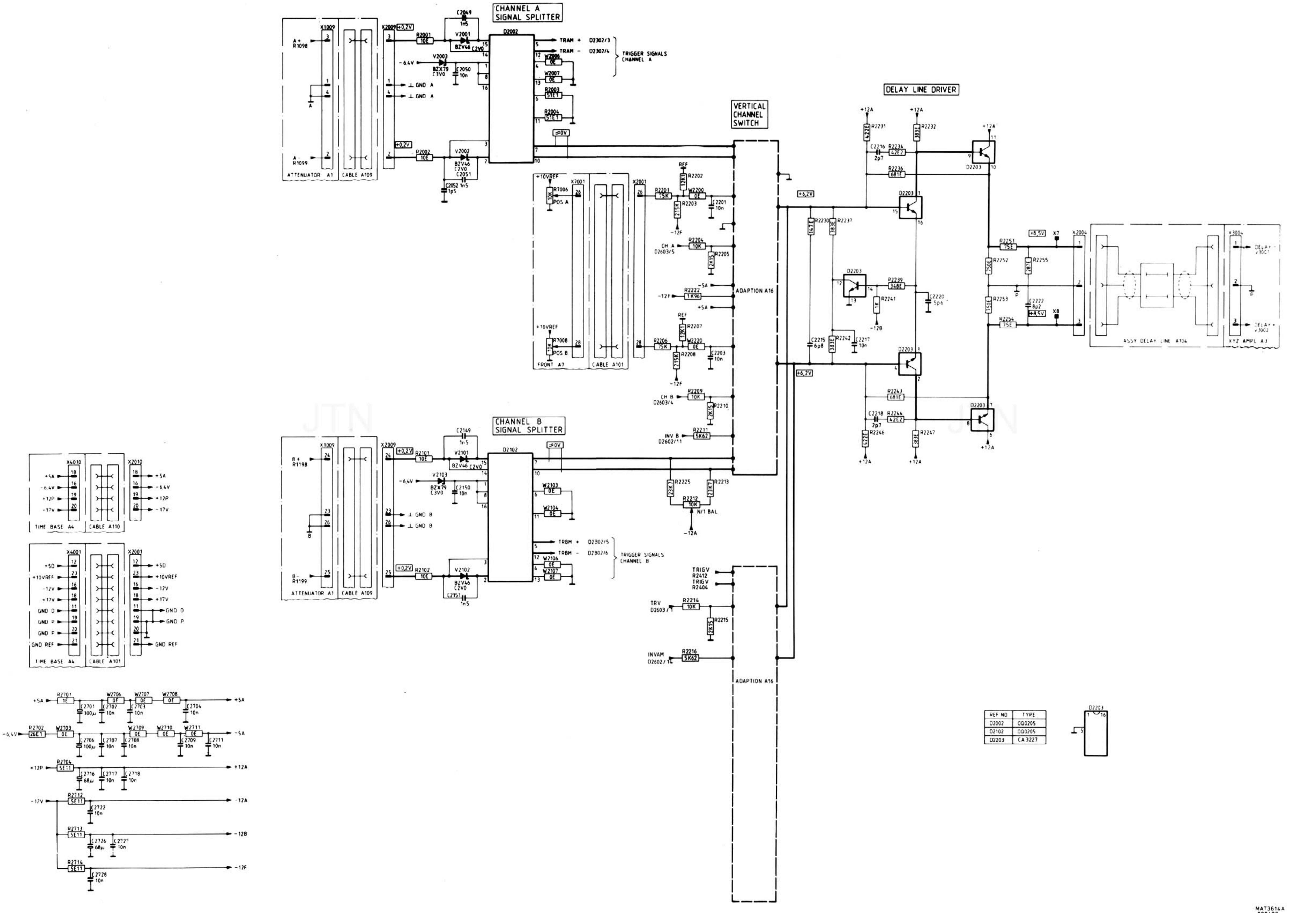
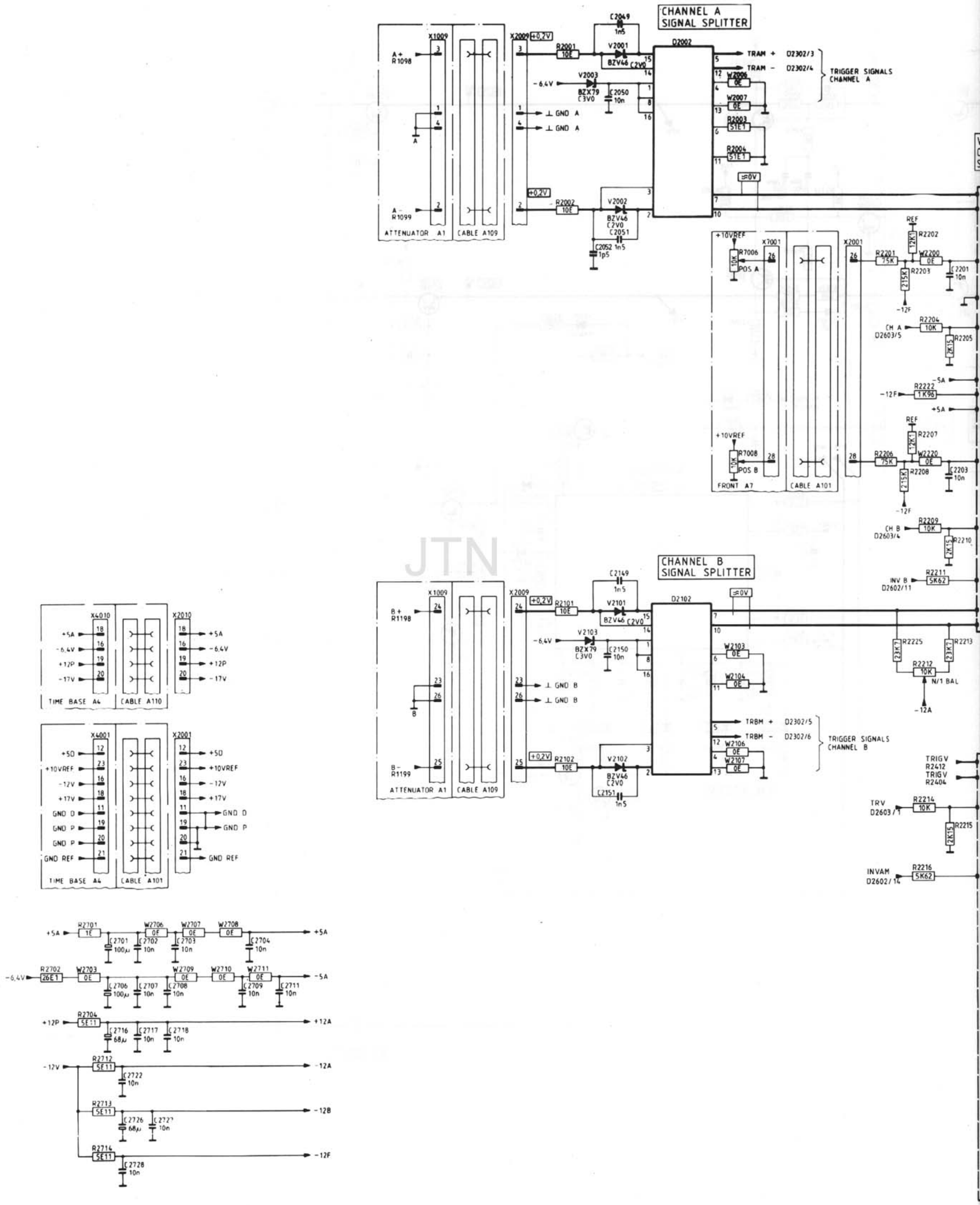
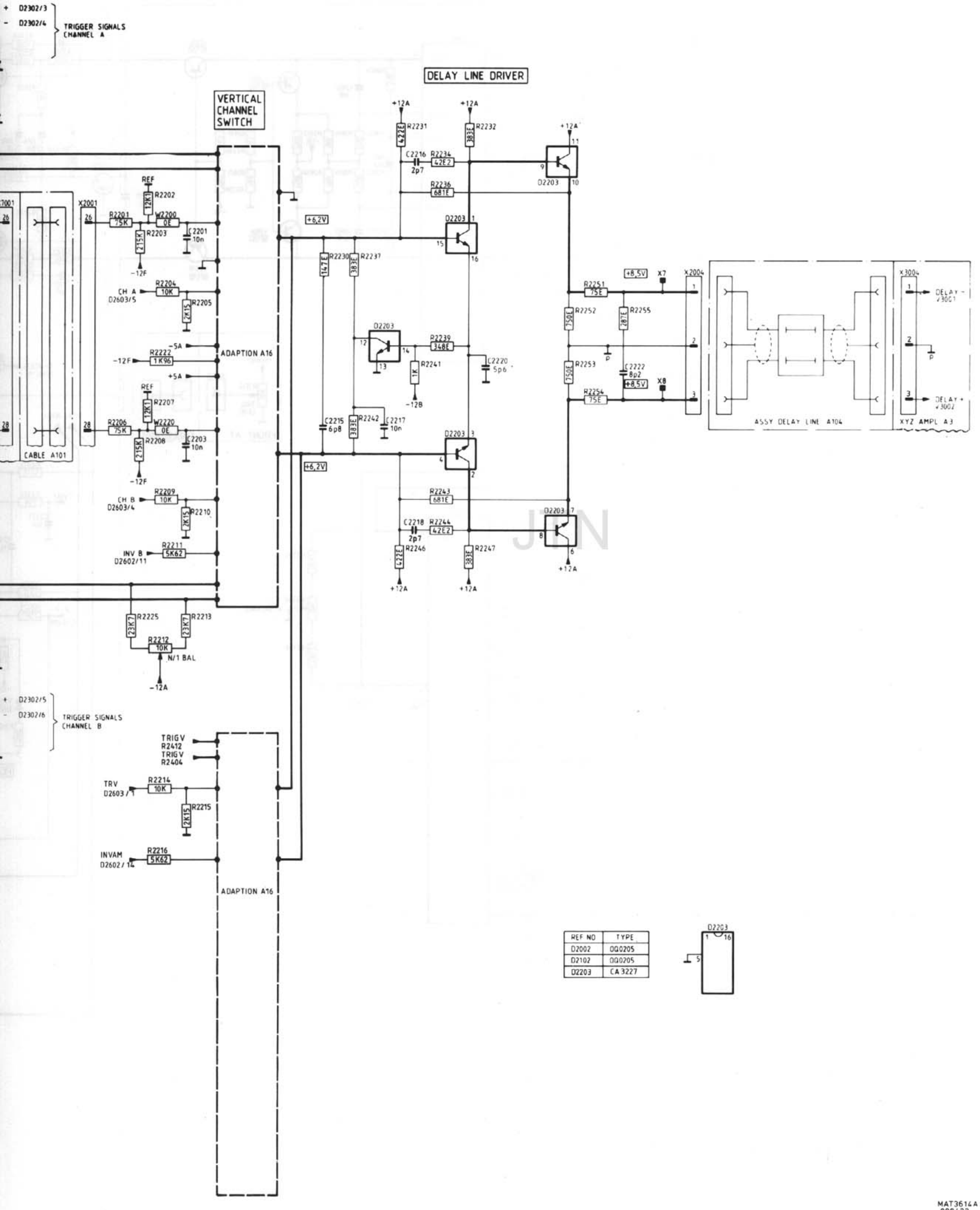


Figure 5.3 Circuit diagram of pre-amplifier: chan. switch and delay line driver

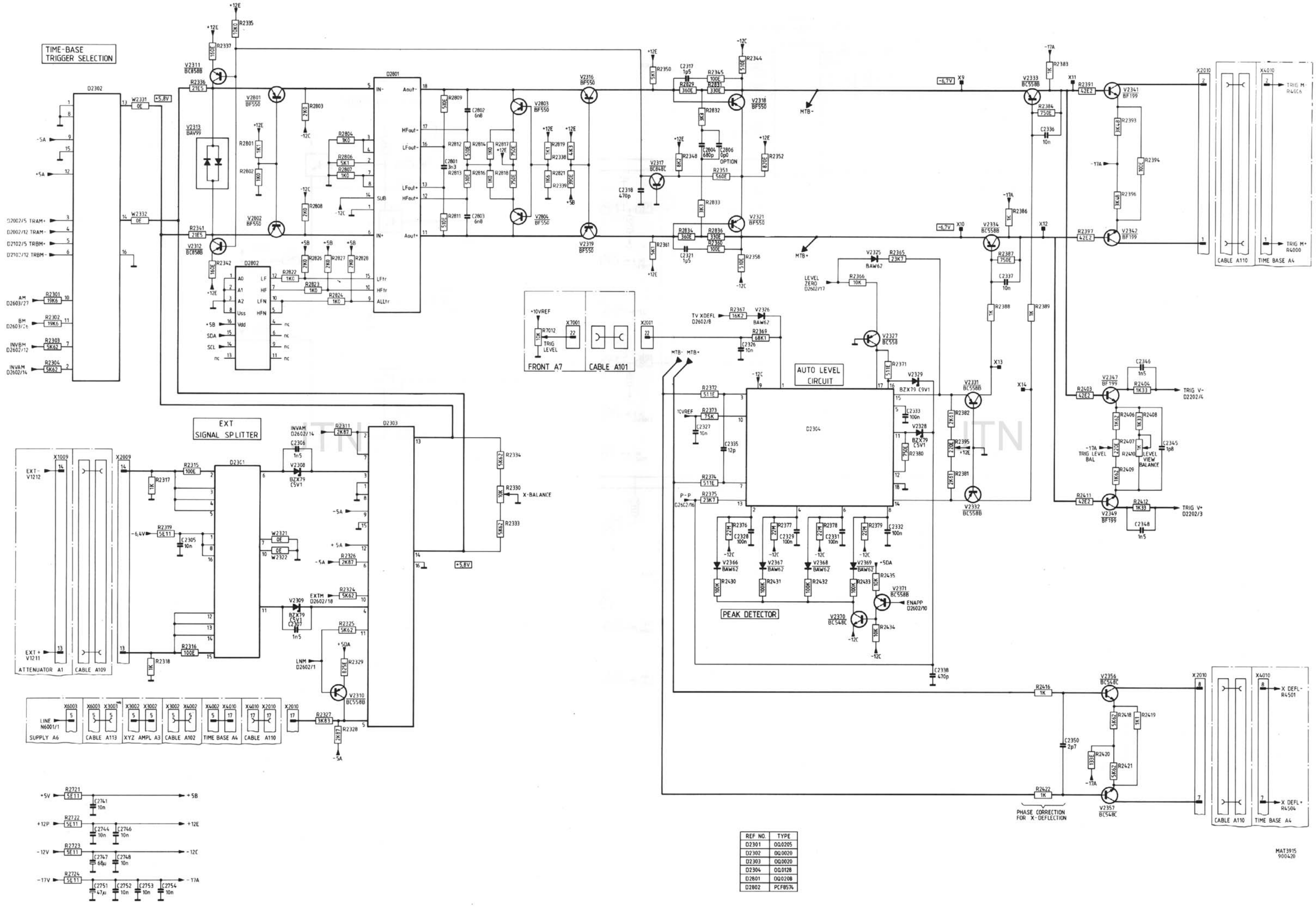


CHANNEL A SIGNAL SPLITTER
CHANNEL B SIGNAL SPLITTER
D2002
D2102
X1009
X2009
X7001
X2001
X4010
X2010
X4001
ATTENUATOR A1
CABLE A109
FRONT A7
CABLE A101
TIME BASE A4
CABLE A110
TRIGGER SIGNALS CHANNEL A
TRIGGER SIGNALS CHANNEL B
TRAM + D2302/3
TRAM - D2302/4
TRBM + D2302/5
TRBM - D2302/6
A+ R1098
A- R1099
B+ R1198
B- R1199
GND A
GND B
POS A
POS B
CH A D2603/5
CH B D2603/4
INV B D2602/11
TRIGV R2412
TRIGV R2404
TRV D2603/1
INVAM D2602/14
N/1 BAL
+5A
-6,4V
+12P
-17V
+5D
+10VREF
-12V
+17V
GND D
GND P
GND REF
-5A
+12A
-12A
-12B
-12F
JTN



REF NO	TYPE
D2002	OQ0205
D2102	OQ0205
D2203	CA 3227

Figure 5.3 Circuit diagram of pre-amplifier: chan. switch and delay line driver



REF NO.	TYPE
D2301	OQ0205
D2302	OQ0020
D2303	OQ0020
D2304	OQ0128
D2801	OQ0208
D2802	PCF8574

Figure 5.4 Circuit diagram of pre-amplifier: trigger switch

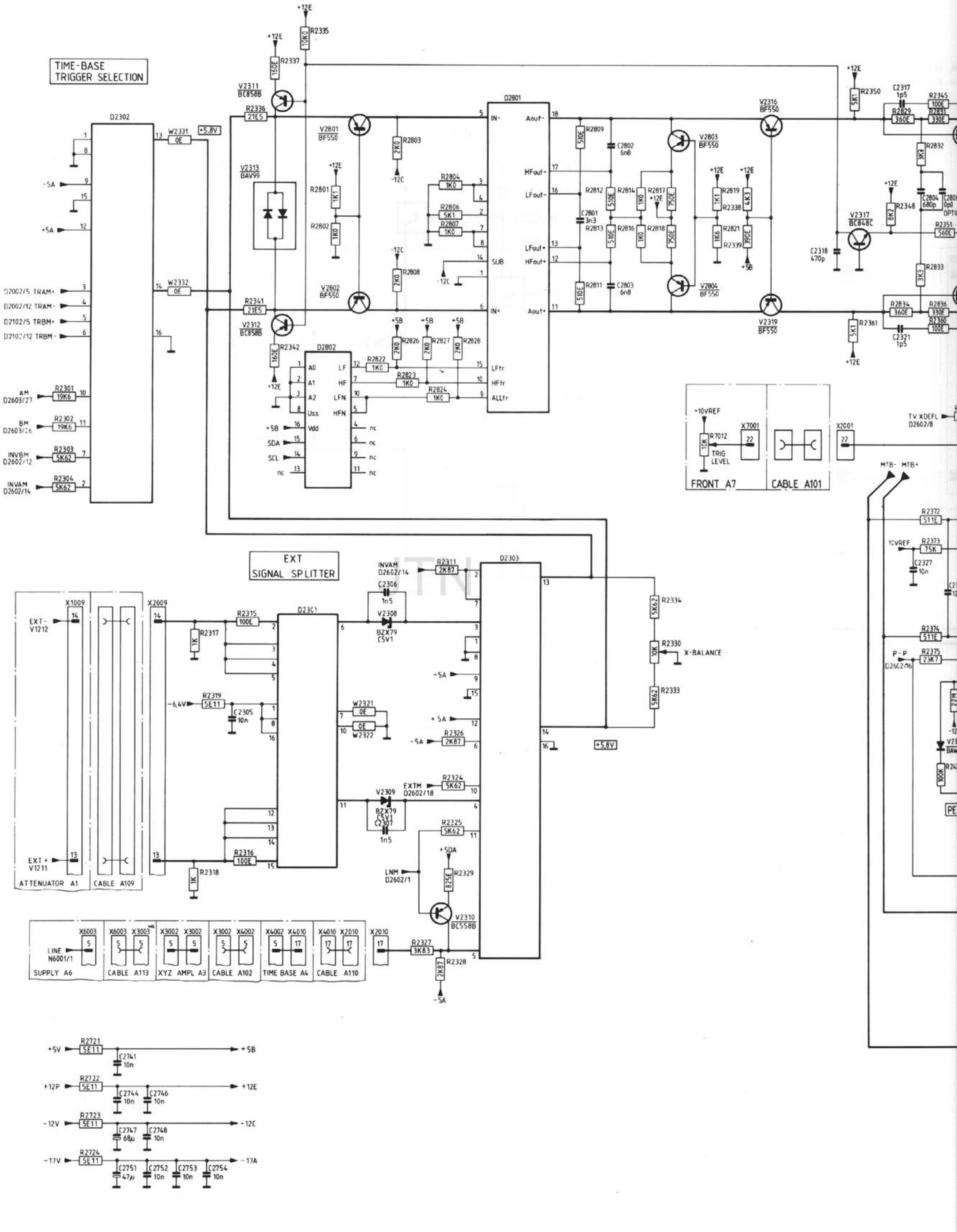
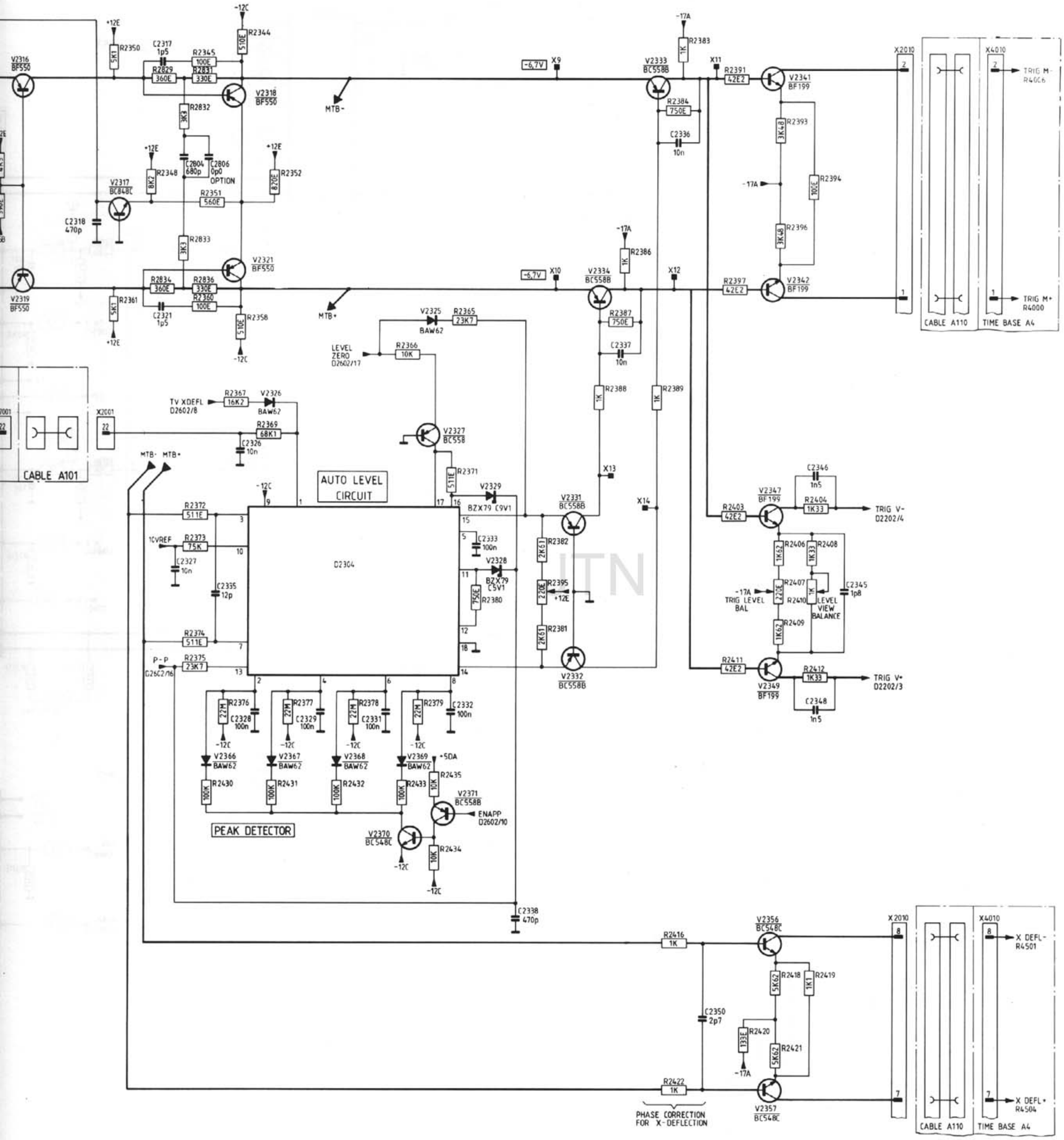
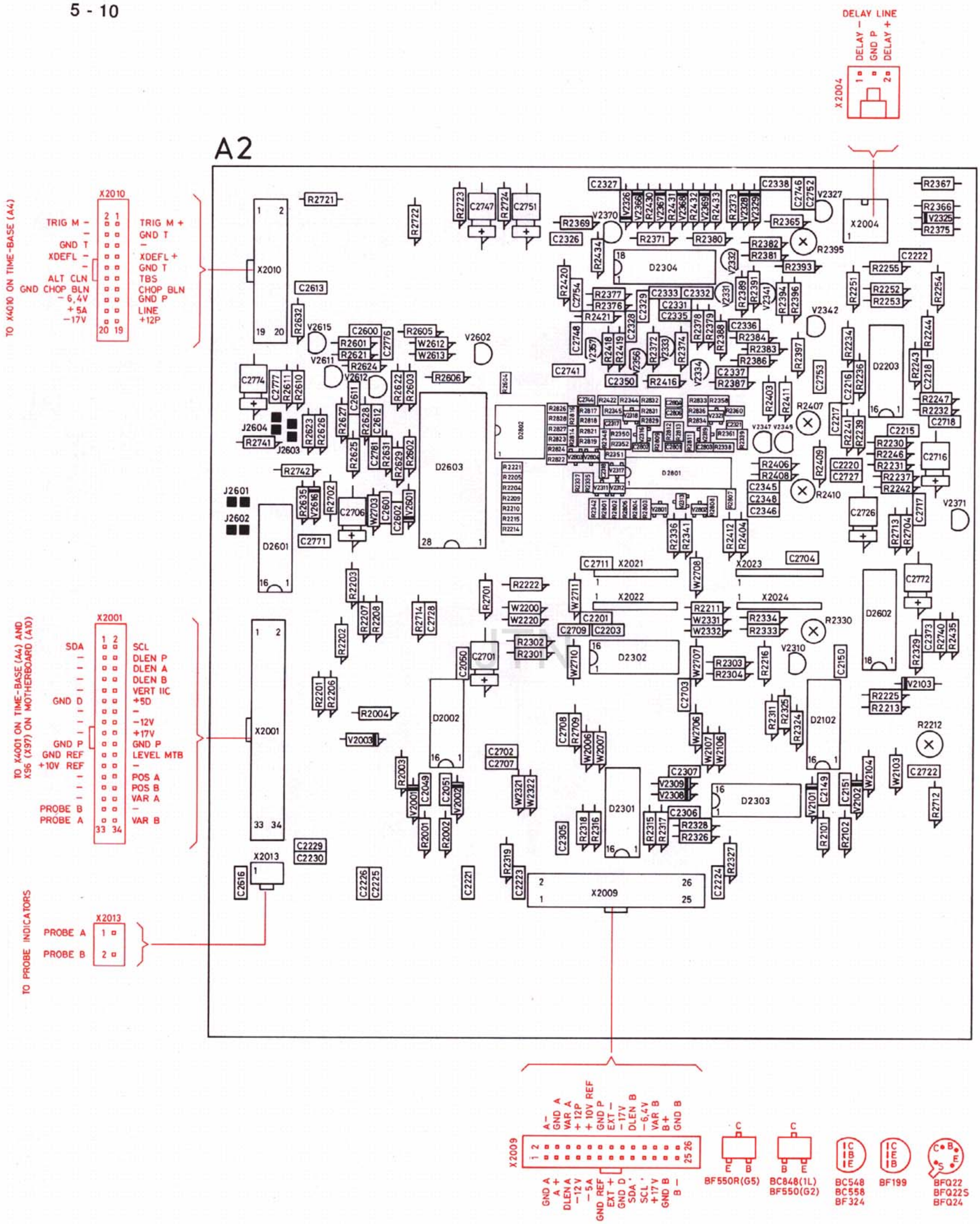


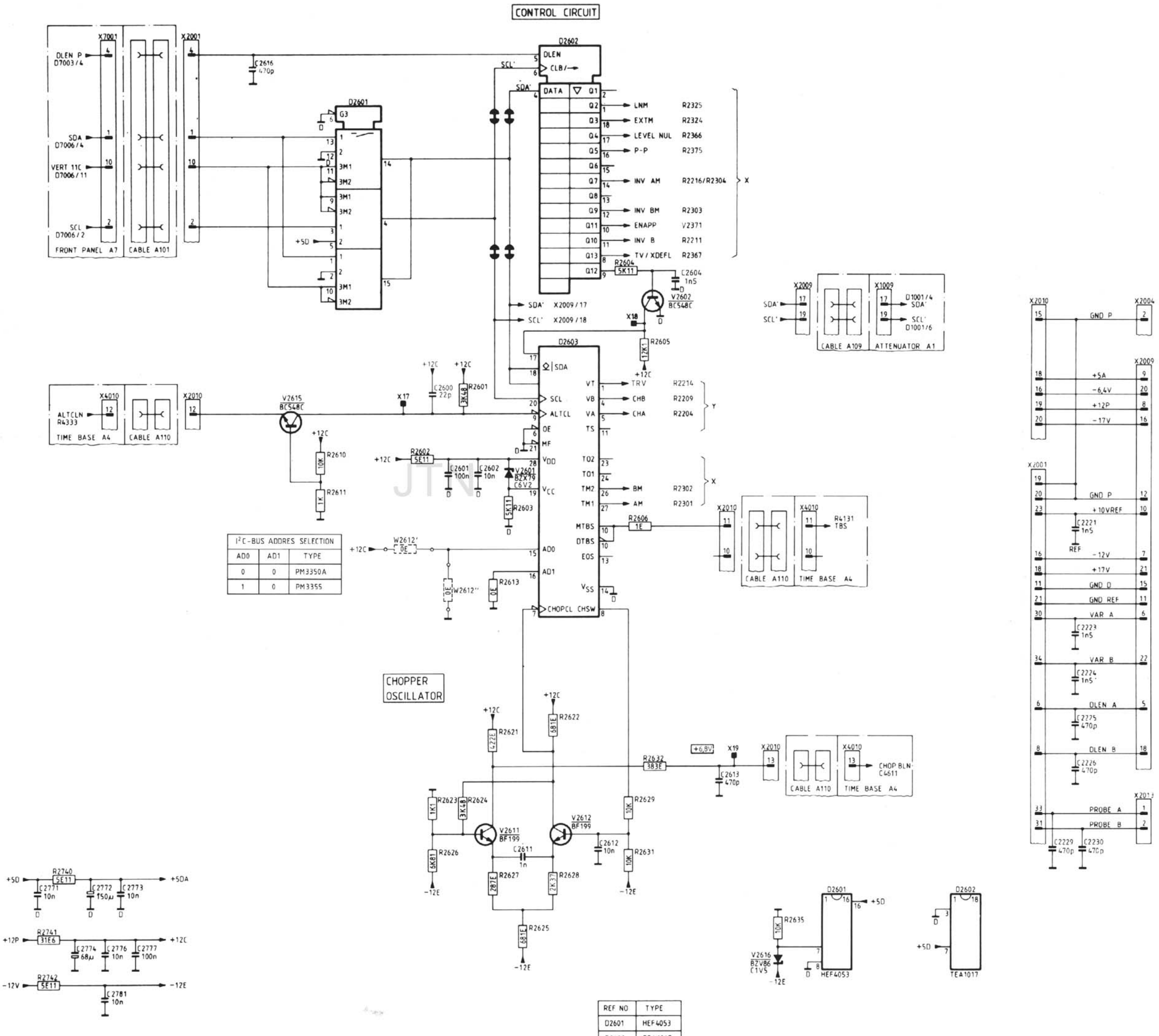
Figure 5.4 Circuit diagram of pre-amplifier: trigger switch



REF NO.	TYPE
D2301	OQ0205
D2302	OQ0020
D2303	OQ0020
D2304	OQ0128
D2801	OQ0208
D2802	PCF8574

MAT3915
900420


A2
DELAY LINE
DELAY −
GND P
DELAY +
X2004
X2010
TRIG M −
GND T
XDEFL −
ALT CLN
GND CHOP BLN
− 6,4V
+ 5A
−17V
TRIG M +
GND T
XDEFL +
GND T
TBS
CHOP BLN
GND P
LINE
+12P
TO X4010 ON TIME-BASE (A4)
X2001
SDA
GND D
GND P
GND REF
+10V REF
PROBE B
PROBE A
SCL
DLEN P
DLEN A
DLEN B
VERT IIC
+5D
−12V
+17V
GND P
LEVEL MTB
POS A
POS B
VAR A
VAR B
TO X4001 ON TIME-BASE (A4) AND X96 (X97) ON MOTHERBOARD (A10)
X2013
PROBE A
PROBE B
TO PROBE INDICATORS
X2009
A−
GND A
VAR A
+ 12P
+ 10V REF
GND P
EXT −
− 17V
DLEN B
− 6,4V
VAR B
B+
GND B
GND A
A +
DLEN A
− 12 V
− 5A
GND REF
EXT +
GND D
SDA
SCL
+17 V
GND B
B −
TO X1009 ON ATTENUATOR (A1)
BF550R(G5)
BC848(1L)
BF550(G2)
BC548
BC558
BF324
BF199
BFQ22
BFQ22S
BFQ24
MAT3613A



I²C-BUS ADDRES SELECTION		
AD0	AD1	TYPE
0	0	PM3350A
1	0	PM3355

REF NO	TYPE
D2601	HEF4053
D2602	TEA1017
D2603	OQ0200

Figure 5.6 Circuit diagram of pre-amplifier: logic control

6 XYZ-AMPLIFIER UNIT (A3)

6.1 INTRODUCTION

Unit A3 incorporates two separate pcb's which are connected via X3001. One pcb includes among other things the CRT socket and is connected at the rear of the CRT. The other pcb, comprising the proper final X, Y and Z amplifiers, is situated at the upper side of the CRT. For ease of description, unit A3 is described as one unit.

The XYZ-amplifier unit consists of:

- Final vertical (Y) amplifier.
- Final horizontal (X) amplifier.
- Final unblanking (Z) amplifier, incl. CRT.

6.2 FINAL VERTICAL (Y) AMPLIFIER.

The final Y-amplifier receives its signal from the delay line and supplies the correct vertical signal to the Y-deflection plates of the CRT. For this, the signal is processed in four stages:

- V3001, V3002 as a series feedback amplifier, including a delay line compensation network and potentiometer R3007 controlling current source V3003 for correction of any unbalance in the Y-deflection plates of the CRT. These circuits are connected between the emitters of both transistors.
  In this stage the input voltage is converted into a current signal.

- V3004, V3006 as a shunt feedback amplifier, which gives a voltage signal to the next stage.

- V3008, V3009 as a series feedback amplifier, including a final RC-correction network and potentiometer R3038 for gain adjustment to compensate the different CRT sensitivities. V3007 supplies a constant current of 60 mA, i.e. 30 mA for each side. Note that the output again supplies a current signal.

- V3011, V3012 as a common-base amplifier for buffering the final Y- amplifier to the Y-deflection plates. The maximum amplitude on each deflection plate is:
  30 mA x 665 E = 20 V approx.

6.3 FINAL HORIZONTAL (X) AMPLIFIER

The input current for X-deflection is obtained from the time-base unit (ref: X- and X+) and processed in three stages, with circuits in the following configurations:

- V3101, V3102 as a common-base amplifier. The current "I" on the collector of both transistors determines the voltage across R3102 and R3116. This voltage is about 1,5 V p-p and feeds the next stage.

- V3103, V3106 as a series feedback amplifier, including a RC- correction network for optimum linearity of the trace and potentiometer R3118 for x1 amplifier adjustment, mounted between the emitters of both transistors. V3104 serves as current source.

- V3112, V3114 are connected as a shunt feedback amplifier, with resistors R3126 and R3134 as the feedback resistors. The transistor source are emitter followers V3109, V3111. This circuit serves as theactual final amplifier, which converts the deflection current into the proper deflection voltage for the X-deflection plates of the CRT. Transistors V3108 and V3116 supply the bias current for the circuit.

6.4 FINAL BLANKING (Z) AMPLIFIER AND CRT

The blanking current derived from the Z pre-amplifier of the time-base unit is routed via common base amplifier V3200 and emitter-follower V3201 to the shunt-feedback amplifier V3202. This stage is fed by current source V3203, which gives a constant current of 4 mA. The voltage on the collector of V3202 can vary between +5 V for unblanking and -35 V for fully blanking.
This Z-pulse may contain d.c., l.f. and h.f. components to be applied to grid G1 of the CRT. Since G1 is at a cathode potential of -2000 V, blocking capacitors are required between G1 and the Z-amplifier output. The h.f. component is directly routed via blocking capacitor C3211 to G1.
However, the d.c. and l.f. components are blocked, so these components are first modulated on a 200 kHz carrier signal by V3207 and V3208 to pass blocking capacitor C3209. Then the signal is demodulated again by V3209 and V3211. Finally, the reconstituted d.c. and l.f. components are added to the h.f. component.

Transistor V3251 forms a nominal 70 V zener circuit which provides the voltage difference between the cathode and G1 of the CRT. This bias voltage ensures blanking when there is no input signal. For adaptation to each CRT, this voltage can be varied between about 40 V and 100 V
by means of R3252 (BLACK LEVEL). Resistor R3254 maintains the filament at the same potential as the cathode.

Any ripple on the cathode voltage is fed-back via transistor V3213 to the input of the Final Z-amplifier and added to the blanking signal. This means that the differential voltage between G1 and the cathode of the CRT is always fixed. Because this differential voltage determines the intensity of the spot, as a result, the intensity is almost independent of the ripple.

The amplifier stage V3253, V3254 and V3256 provides amplification for the range of the FOCUS control. The range of 0... +10 V gives a final
range on G3 of the CRT of -1350 V ... -1600 V.

Resistor R3257 connects the INTENS control to the focus adjustment to maintain a sharply defined trace at varying brightness.

For optimum presetting of the GEOMETRY, the voltage on G5 of the CRT is set to a fixed level of -30 V. The ASTIGMATISM can be varied by means of potentiometer R3267.

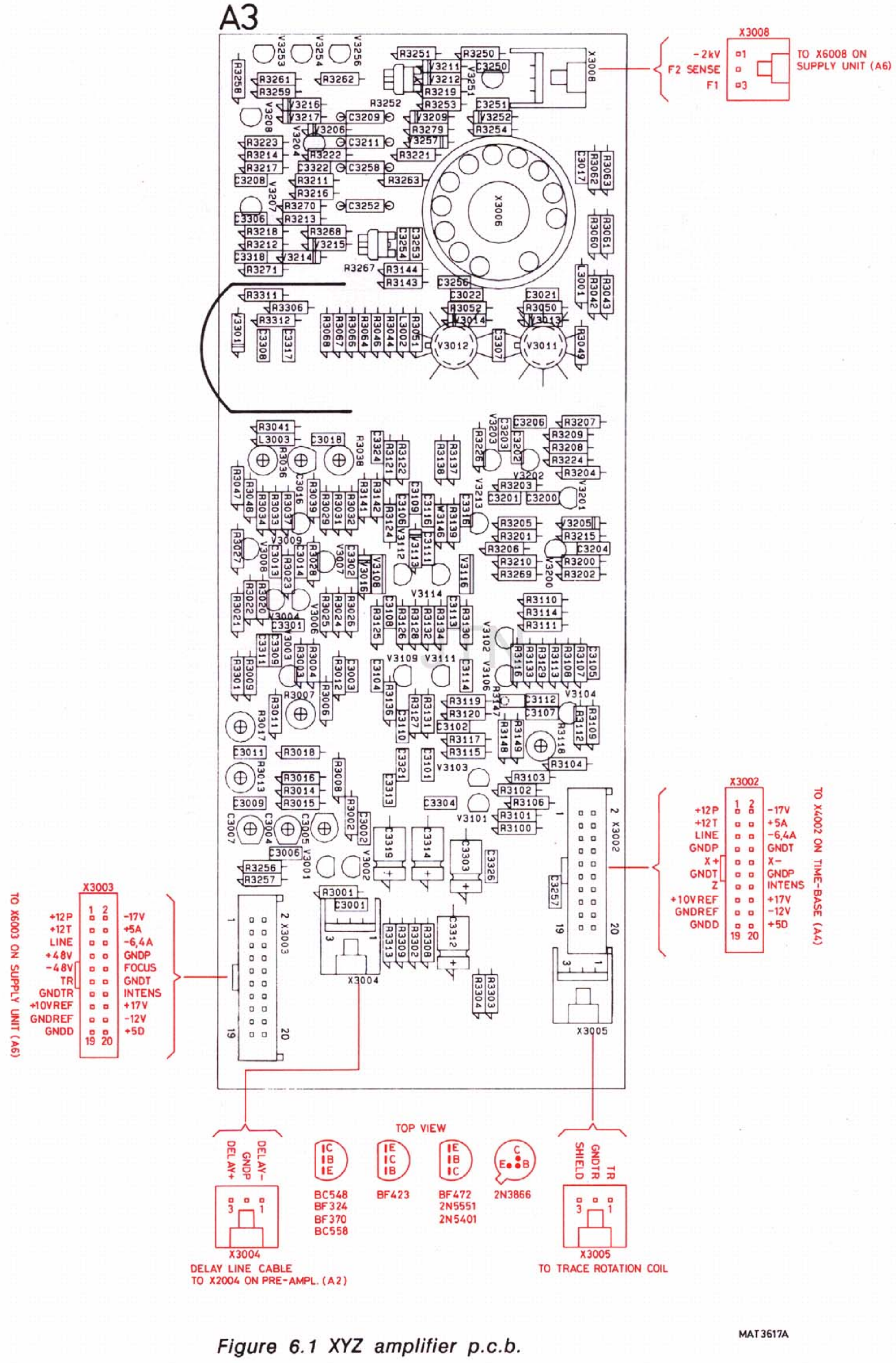


Figure 6.1 XYZ amplifier p.c.b.

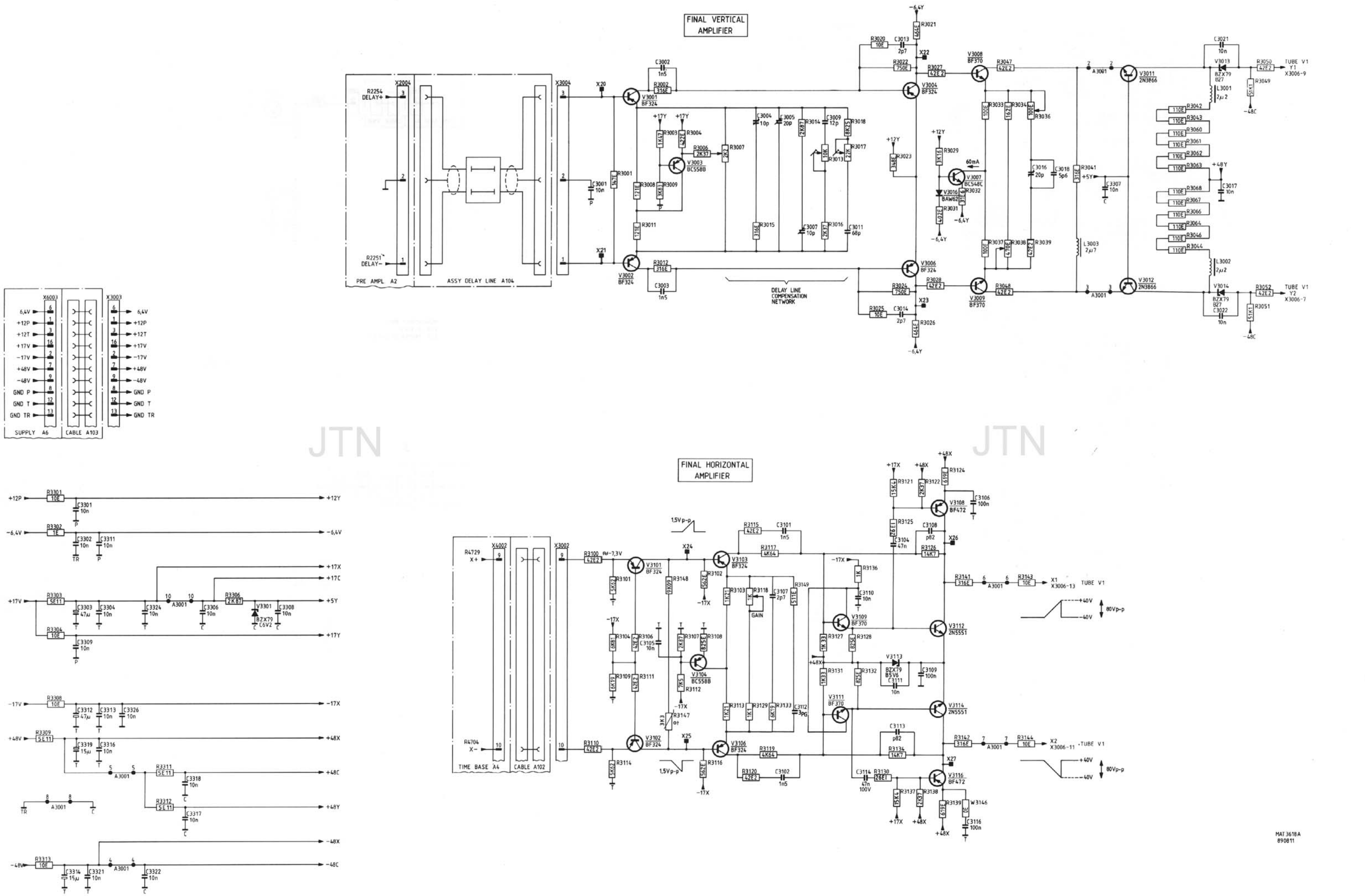
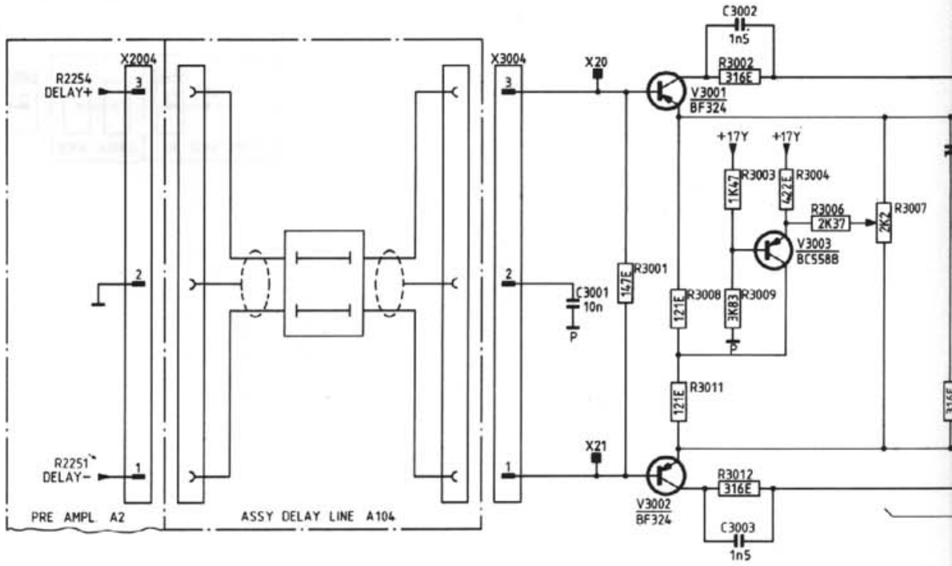
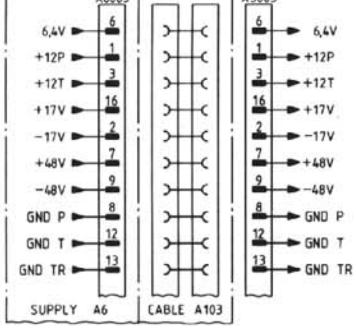
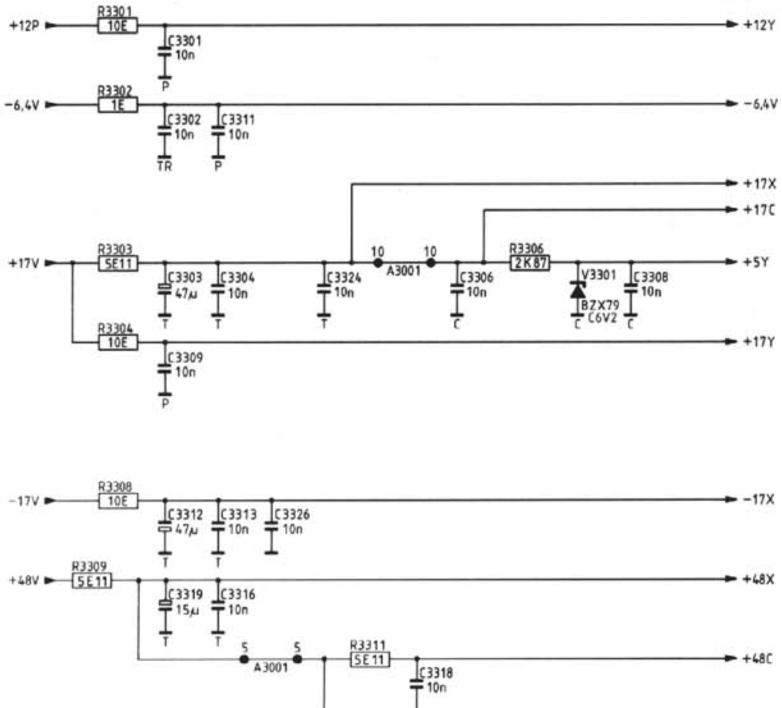


Figure 6.2 Circuit diagram of XYZ amplifiers: final X and Y amplifiers

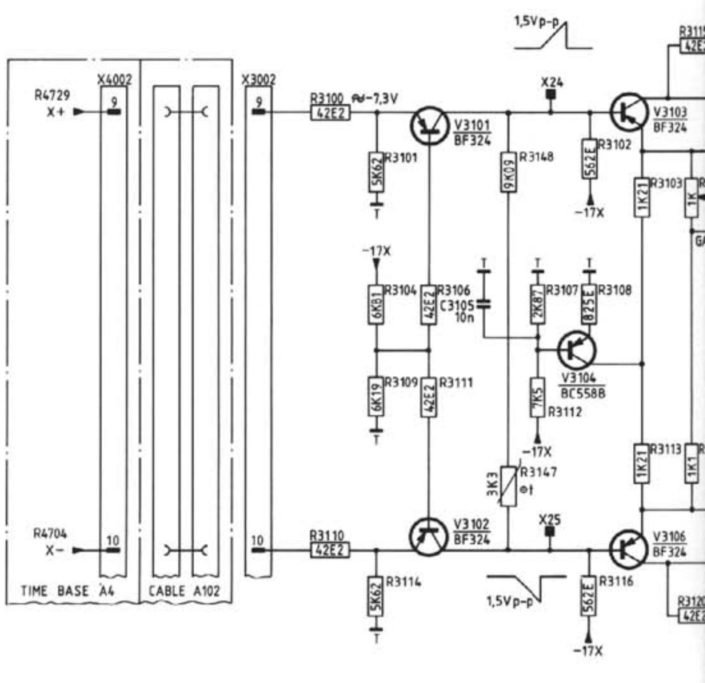
FINAL VERTICAL AMPLIFIER







FINAL HORIZONTAL AMPLIFIER



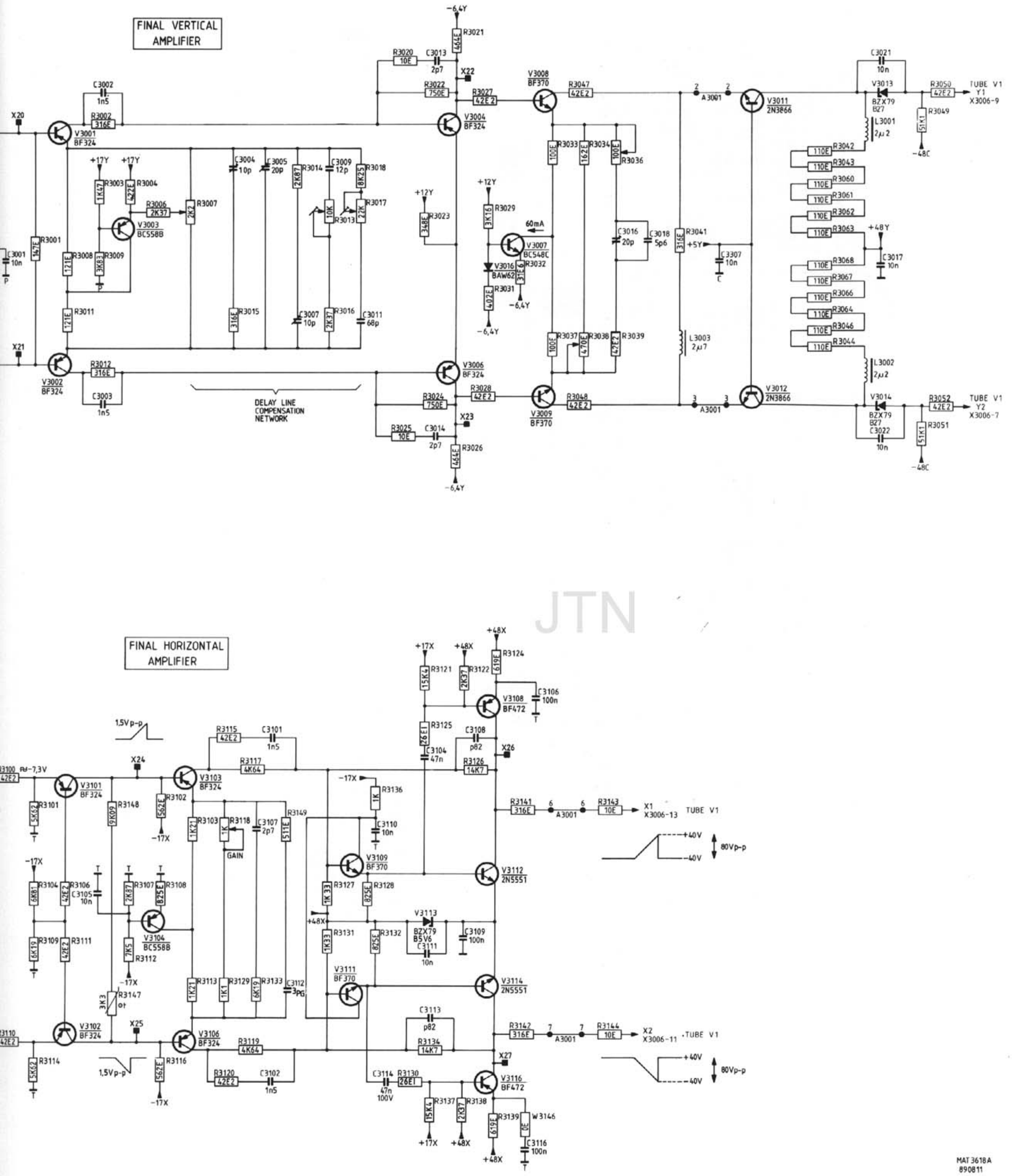


Figure 6.2 Circuit diagram of XYZ amplifiers: final X and Y amplifiers

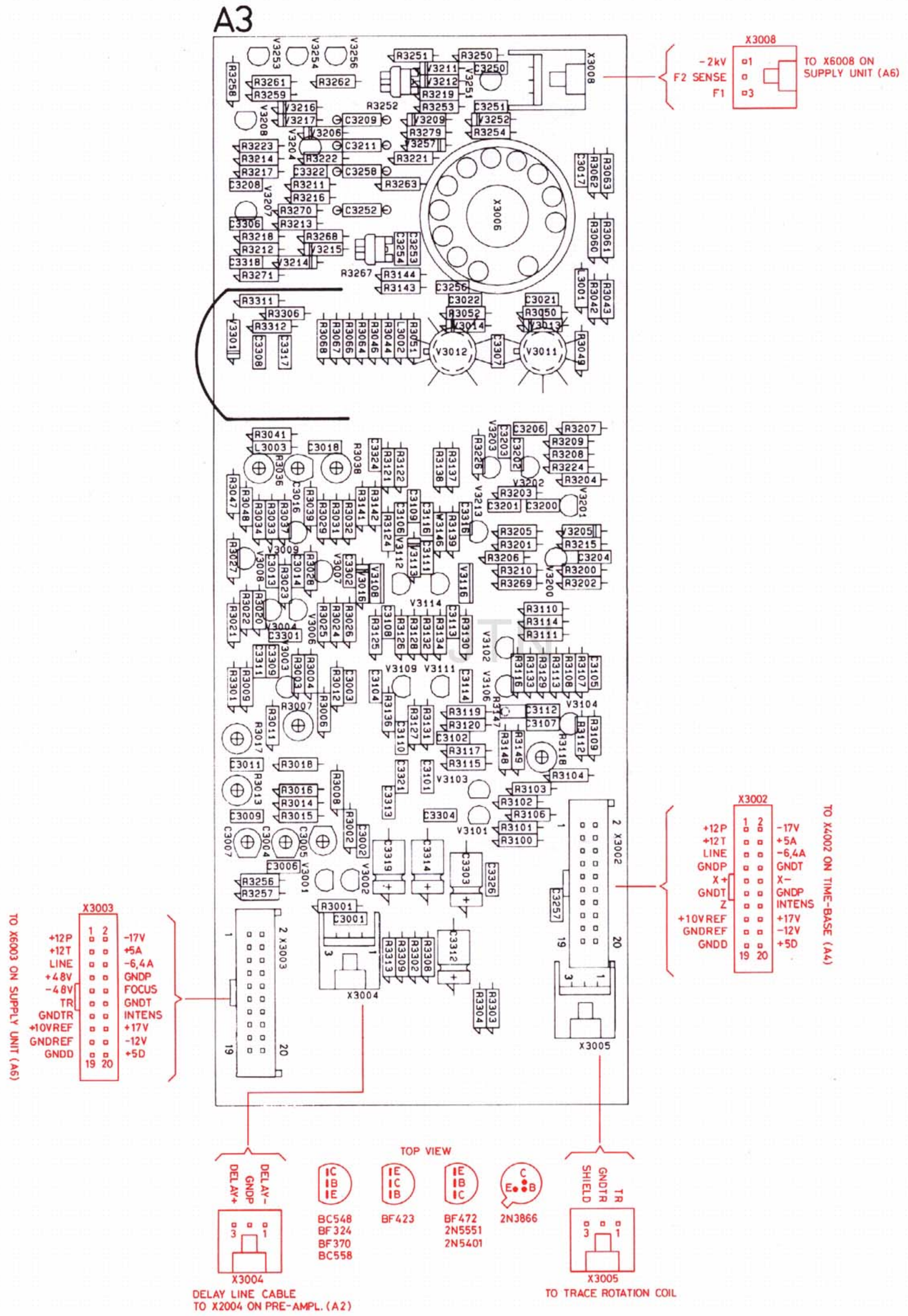


Figure 6.3 XYZ amplifier unit p.c.b.

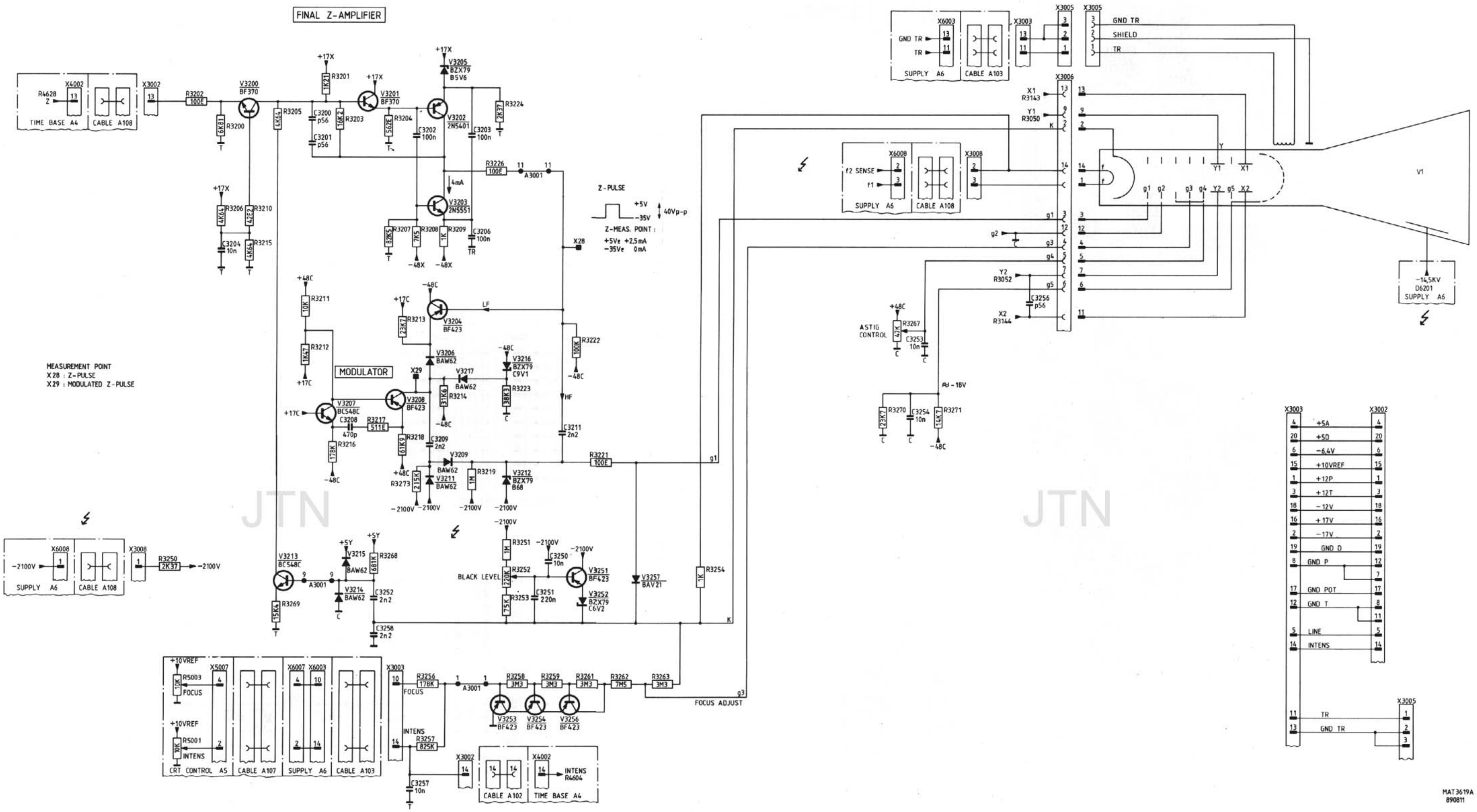
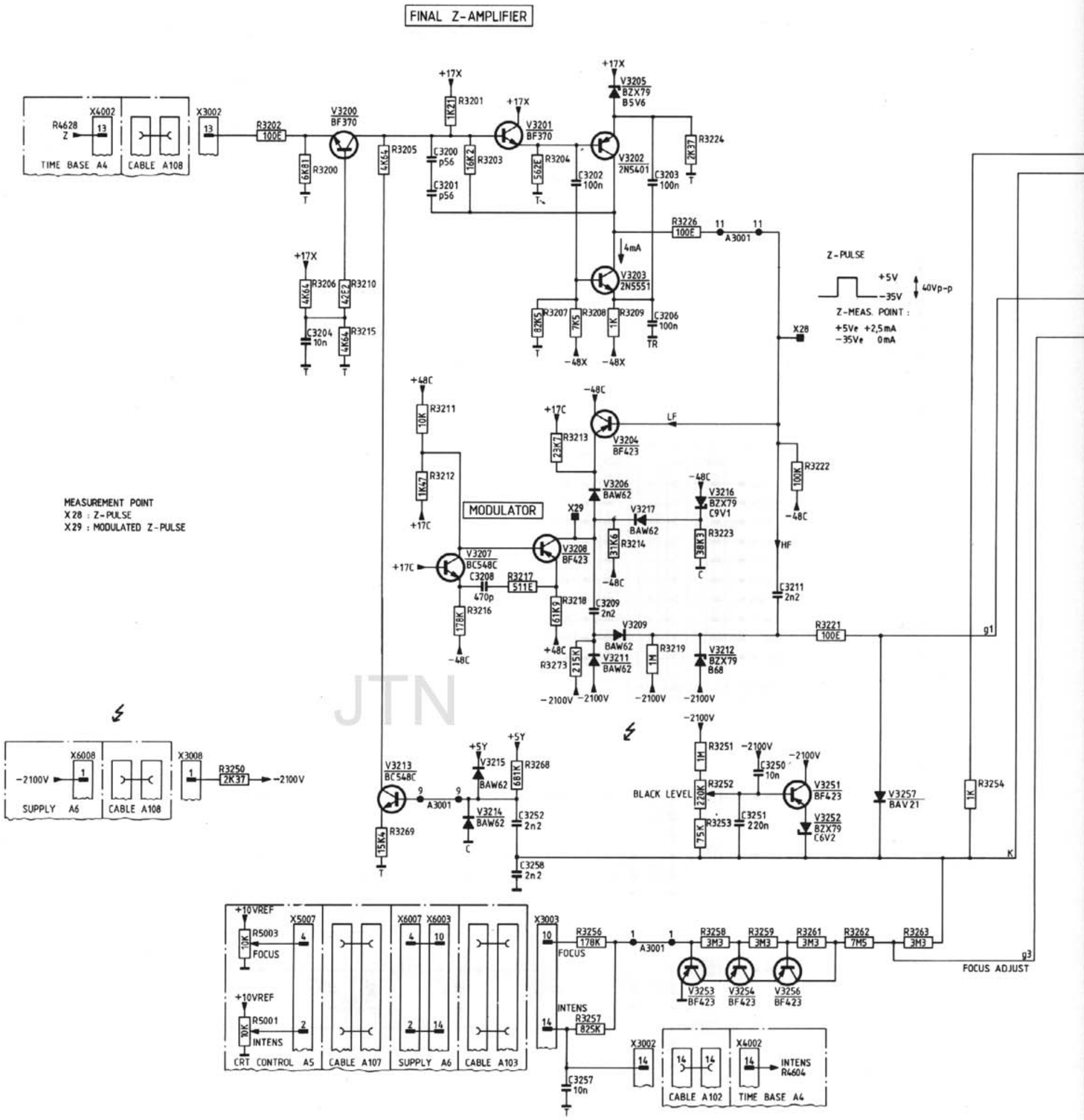


Figure 6.4 Circuit diagram of XYZ amplifiers: Z amplifier and CRT circuit


FINAL Z-AMPLIFIER
MODULATOR
MEASUREMENT POINT
X28 : Z-PULSE
X29 : MODULATED Z-PULSE
Z-PULSE
+5V
-35V
40Vp-p
Z-MEAS. POINT :
+5Ve +2,5mA
-35Ve 0mA
TIME BASE A4
CABLE A108
SUPPLY A6
CRT CONTROL A5
CABLE A107
CABLE A103
CABLE A102
BLACK LEVEL
FOCUS
INTENS
FOCUS ADJUST
V3200 BF370
V3201 BF370
V3202 2N5401
V3203 2N5551
V3204 BF423
V3205 BZX79 B5V6
V3207 BC548C
V3208 BF423
V3213 BC548C
V3251 BF423
V3253 BF423
V3254 BF423
V3256 BF423
V3257 BAV21
-2100V

Figure

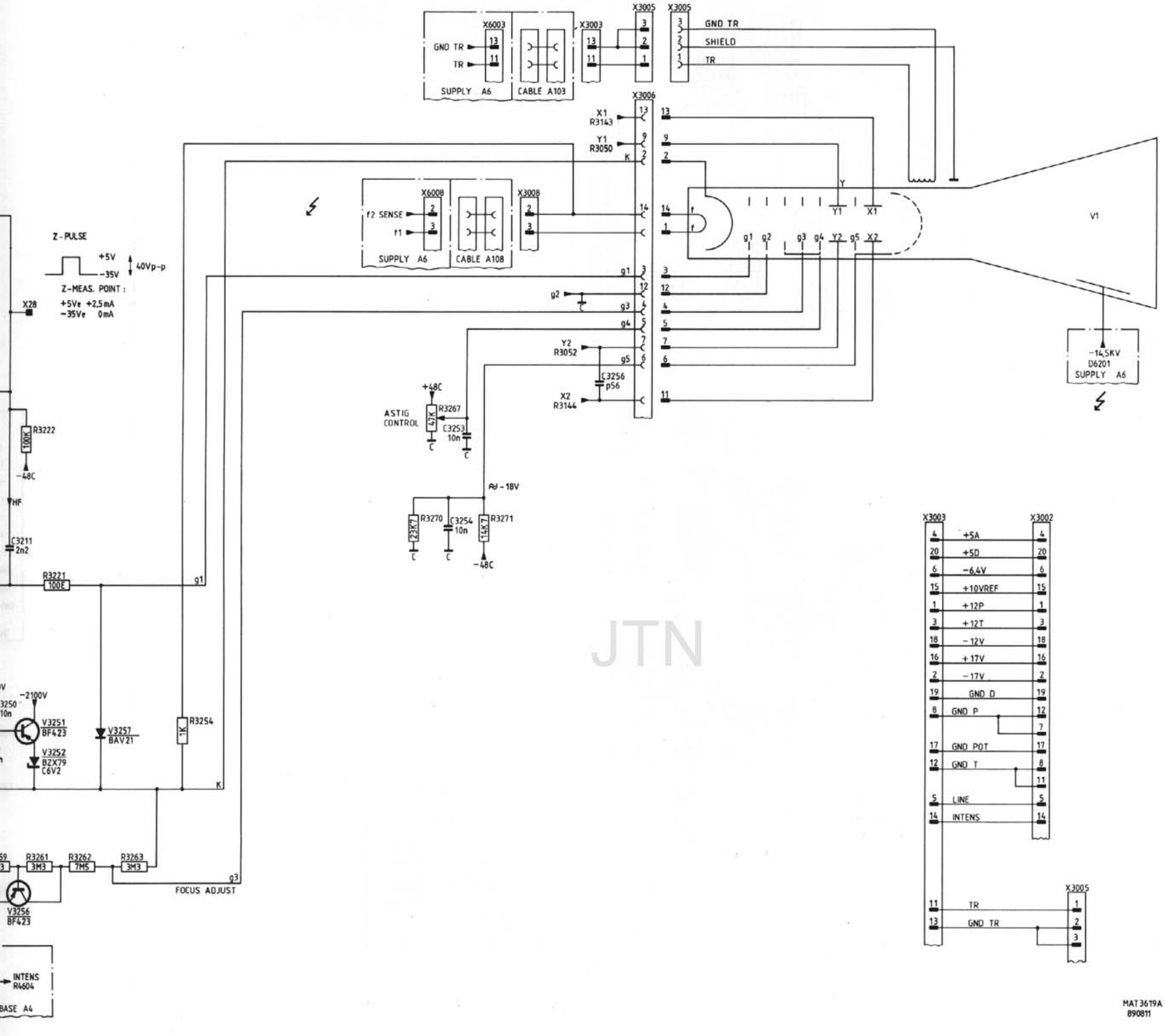


Figure 6.4 Circuit diagram of XYZ amplifiers: Z amplifier and CRT circuit

7 TIME-BASE UNIT (A4)

The time-base unit consists of:

- Trigger amplifier
- Timing circuit
- Sweep generator
- X DEFL amplifier, incl. horizontal display mode switch
- Horizontal pre-amplifier
- Z amplifier

As a supplement, the timing diagram for several conditions of the time base is given in section 7.6.

All control pulses for this unit are generated by the time-base control circuit, via the I^2C bus. Integrated circuits D4001 and D4002 convert this series DATA into the parallel control pulses, provided that DLEN TB1, and DLEN TB2 are HIGH.

7.1 TRIGGER AMPLIFIER

* **TB triggering**:

The symmetrical trigger current signals TRIGM+ and TRIGM- are derived from the pre-amplifier unit and converted into the asymmetrical trigger voltage via the shunt feedback amplifier V4003 and V4006. The amplification of this trigger signal is the summation of the voltage swings across R4002 and R4003, which are proportional to the current swing of TRIGM+ and TRIGM-.

* **TV triggering**:

When the signal TVMTB goes LOW, the normal trigger path is blocked via V4005 and V4007 and the trigger signal is routed via the TV trigger stage V4009...V4018. Transistor V4009 serves to clip the synchronisation pulse and LINE/FRAME selection is obtained by 4016.

7.2 TIMING CIRCUIT

(see figure 7.1)

The timing for the entire time-base circuit is obtained by D4103 together with its associated components.

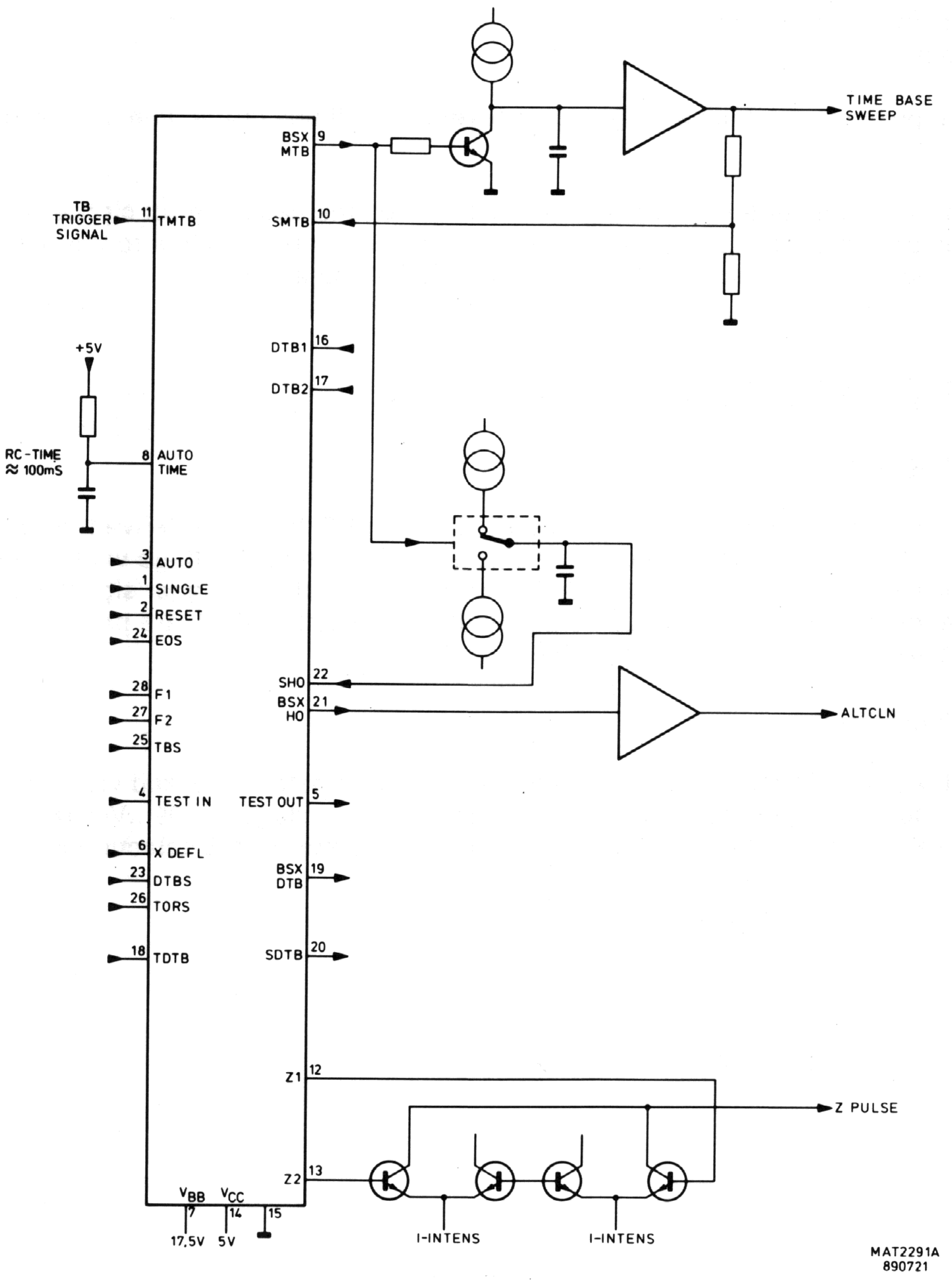


Figure 7.1 D4103 configuration

D4103 has the following relevant pin connections:

Pin	Name	INPUT-OUTPUT	Description
1	SINGLE	TTL-input	Selects the single time-base mode.
2	RESET	TTL-input	Stops the sweep and starts the hold off sweep.
3	AUTO	TTL-input	Selects the AUTO trigger mode, the time-base isfree-running after the last trigger pulse.
4	TESTIN	TTL-input	Selects the possibility to drive several functions (TESTOUT) in combination with SINGLE and RESET.
5	TESTOUT	TTL-output	--
6	X DEFL 1	TTL-input	Activates the Z1 and Z2 outputs.
7	Vbb	-	+1,5 V supply input.
8	AUTOTIME	input	RC-time determination (100 ms) for the AUTO trigger mode.
9	BSXMTB	TTL-output	Discharges the TB-sweep capacitor(s).
10	SMTB	SCHMITT-input	Determines the end of the TB-sweep.
11	TMTB	SCHMITT-input	Determines the start of the TB-sweep.
12	Z1	TTL-output	Determines the blanking of the CRT.
13	Z2	TTL-output	Determines the blanking of the CRT.
14	GND	-	Ground.
15	Vcc	-	+5 V supply input.
16	CLKHLDHT	SCHMITT-input	Determines the hold mode of the track & hold circuit.
17	DTB2	-	not used, connected to ground.
18	TDTB	-	not used, connected to ground.
19	CLKHLDLT	TTL-output	Determines the hold mode of the track & hold circuit.
20	SDTB	-	not used, connected to ground.
21	BSXHO	TTL-output	Determines the ALT clock pulse.
22	SHO	SCHMITT-input	Determines the end of the Hold-off sweep.
23	DTBS	-	not used; connected to +5Z.
24	EOS	-	not used; connected to +5Z.
25	TBSX	TTL-input	Determines the TB-unblanking (HIGH).
26	TORS	TTL-input	Determines the STARTS condition (LOW) or TRIG'D condition (HIGH) of the DTB.
27	F2	TTL-input }	Determines the time-base display
28	F1	TTL-input }	mode (both LOW).

NOTE: All SCHMITT-inputs are at +2,5 V level.

7.3 SWEEP GENERATORS

* **TB sweep generator** (see figure 7.2):

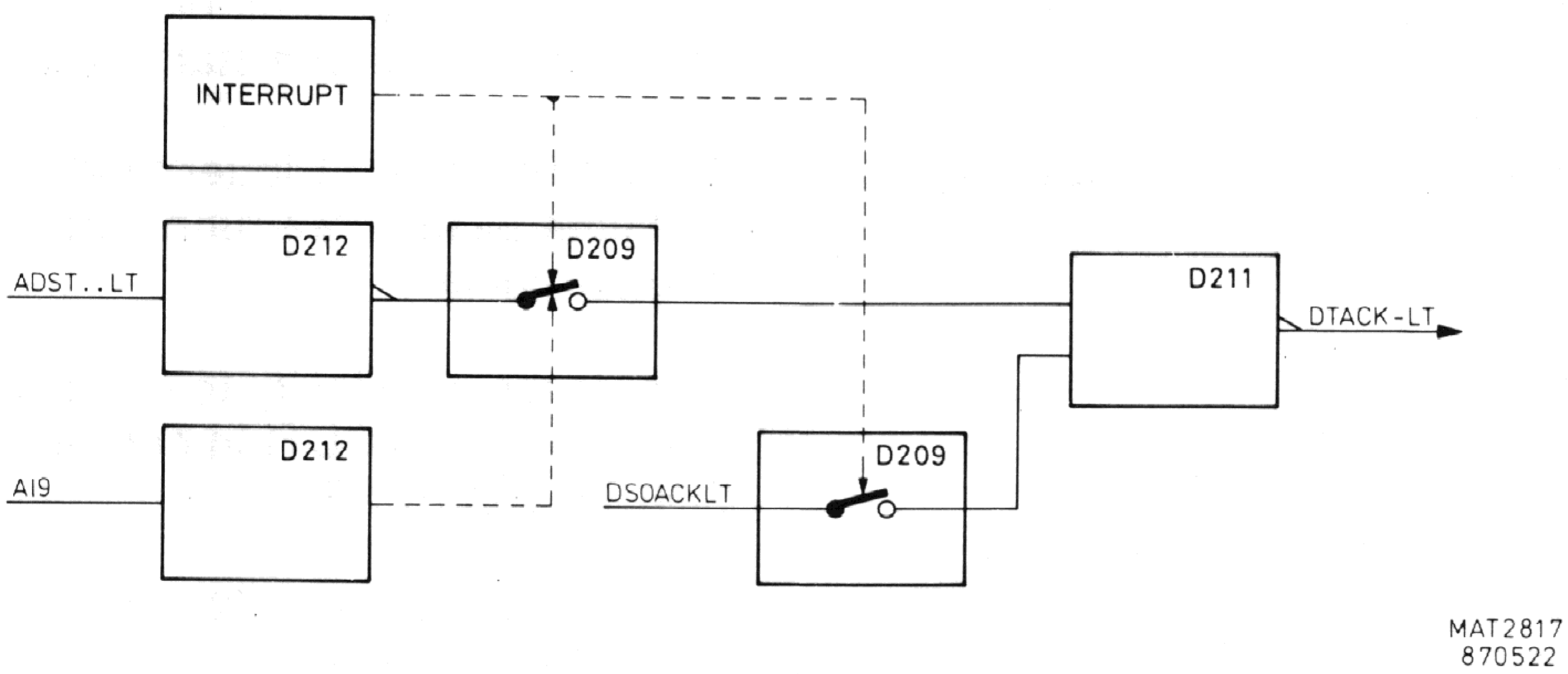


Figure 7.2 Simplified diagram of the time-base sweep generator

The sawtooth charging current:

$$Ic = \frac{Uc}{R4143\ (+\ R4144)}$$

determines the sweep speed via C4113 and C4114. These capacitors are discharged by V4114. The circuit is controlled by the following address lines:

- MA0...MA2, for interconnection of D4102-3 to an input pin, thus giving six different voltage levels Ul with respect to +14,6 V.
- MREED, for addition of R4144 to the sawtooth charging circuit.
- MC, for addition of C4114 to the sawtooth charging circuit and for switching over between calibration pot.meters R4107 (50ns...100μs) and R4108 (200 μs...0,5 s).

The voltage Ul can be continuously varied by moving the VAR TB control R7009 from the CAL position. Thus a sweep variation of 1:2,5 can be obtained.

Function table for the sweep generator in ANALOG time-base modes:

sweep speed	MA2	MA1	MA0	MREED	MC
50 ns/div.	1	1	1	0	0
.1 μs/div.	0	1	0	0	0
.2	0	0	1	0	0
.5	0	0	0	0	0
1	0	1	1	0	0
2	1	0	0	1	0
5	1	1	1	1	0
10	0	1	0	1	0
20	0	0	1	1	0
50	0	0	0	1	0
.1 ms/div.	0	1	1	1	0
.2	1	0	0	0	1
.5	1	1	1	0	1
1	0	1	0	0	1
2	0	0	1	0	1
5	0	0	0	0	1
10	0	1	1	0	1
20	1	0	0	1	1
50	1	1	1	1	1
.1 s/div.	0	1	0	1	1
.2	0	0	1	1	1
.5	0	0	0	1	1

NOTE: When MREED is low, the RELAY is switched on.

The sawtooth current is fed to the buffer circuit, where the h.f. sweep components (to 2 μsec) are routed via C4116 and V4118, V4119.
The l.f. sweep components (0,5 sec...2 μsec) are routed via N4103.

Finally the time-base sweep voltage is applied to the horizontal display mode switch.

*** Hold-off circuit**:

During the time base sweep, capacitor C4304 is discharged. In the lower sweepspeeds (lower then 10 μs) capacitor C4302 is also discharged via V4306. After the sweep, the capacitor(s) are charged via current source V4304, until the voltage across C4304 reaches the +2,5 V level. This voltage is applied to D4103 as the SHO signal and determines if the time base can generate a new sweep.

Depending on the HOLD OFF control potentiometer R7011 adjustment, a part of the charging current leaks away via V4301 and thus continuously variation of the charging time (i.e. hold-off time) is obtained. When BSXMTB goes LOW, the time base starts to run again and at the same time C4304 (and C4302) are discharged again via V4309.

7.4 X DEFL AMPLIFIER AND DISPLAY MODE SWITCH

*** X DEFL amplifier**:

The circuit for converting the symmetrical X DEFL+ and X DEFL- signals into the asymmetrical voltage, applied to the display mode switch is identical to the trigger input. However, this circuit can be switched off by diodes V4500 and V4505, provided that the X DEFL signal is HIGH.

*** Horizontal display mode switch**:

The three deflection signals for real time base, digital time base or X deflection are switched to the horizontal pre-amplifier via diode switches. These switches are under control of the signals X DEFL and TBS. The output of the circuit is applied to R4701 on the horizontal pre-amplifier stage. The logic table is given below:

X DEFL	TBS	Output
1	*	X DEFL signal
0	0	Digital time base
0	1	Analog time base

7.5 Z-AMPLIFIER

*** Z-switch**:

The Z-switch N4601 is configured as two differential amplifiers with a common current output to R4625. The stage is supplied by a constant current source via pin 1 and pin 8. The inputs Z1 and Z2 are derived from the timer stage D4103 and determine the unblanking of the CRT. For this oscilloscope, Z1 and Z2 must be HIGH for normal intensity of the time base signal.
The amplitude of the Z-current can be varied by the front-panel INTENS control R5001. The slider of this control potentiometer drives the base pin 2 and pin 7 of both current sources.

To prevent burn-in of the CRT in the lower sweep speeds 50 μsec...0,5 sec, signal ZB is LOW and reduces the voltage to pin 2 and pin 7.

Signal ZA is a software-controlled pulse to blank the trace when the AMPL/DIV switch is used.

*** Z Pre-amplifier**:
In normal condition, all current for CRT blanking derived from N4601 is routed via R4625, V4612 and R2628 to the XYZ Amplifier A3.

However, there are two conditions for additional blanking:

- In the chopped mode of the vertical channels the display is blanked during switching over between channels. This happens by connecting the CHOPBLN pulse to V4611. When this pulse is HIGH, transistor V4611 conducts and a part of the blanking current flows via V4611 e-c to the +5 kV rail.

- If a HIGH level is applied to the external Z MOD input on the rear panel, this signal causes conducting of V4616 so that a part of the blanking current flows via V4616 e-c to the +5 kV rail.

7.6 TIMING DIAGRAM

The following figure gives the timing diagram for D4103 for a free running time base sweep.

SINGLE	0
RESET	0
AUTO	1
TEST IN	0
X DEFL	0
TORS	0
F1	0
F2	0
DTBS	0
EOS	1
TBS	1

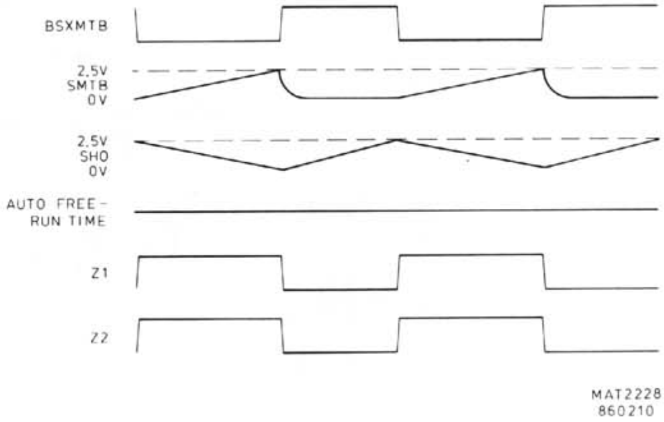


Figure 7.3 Free-running sweep-timing diagram

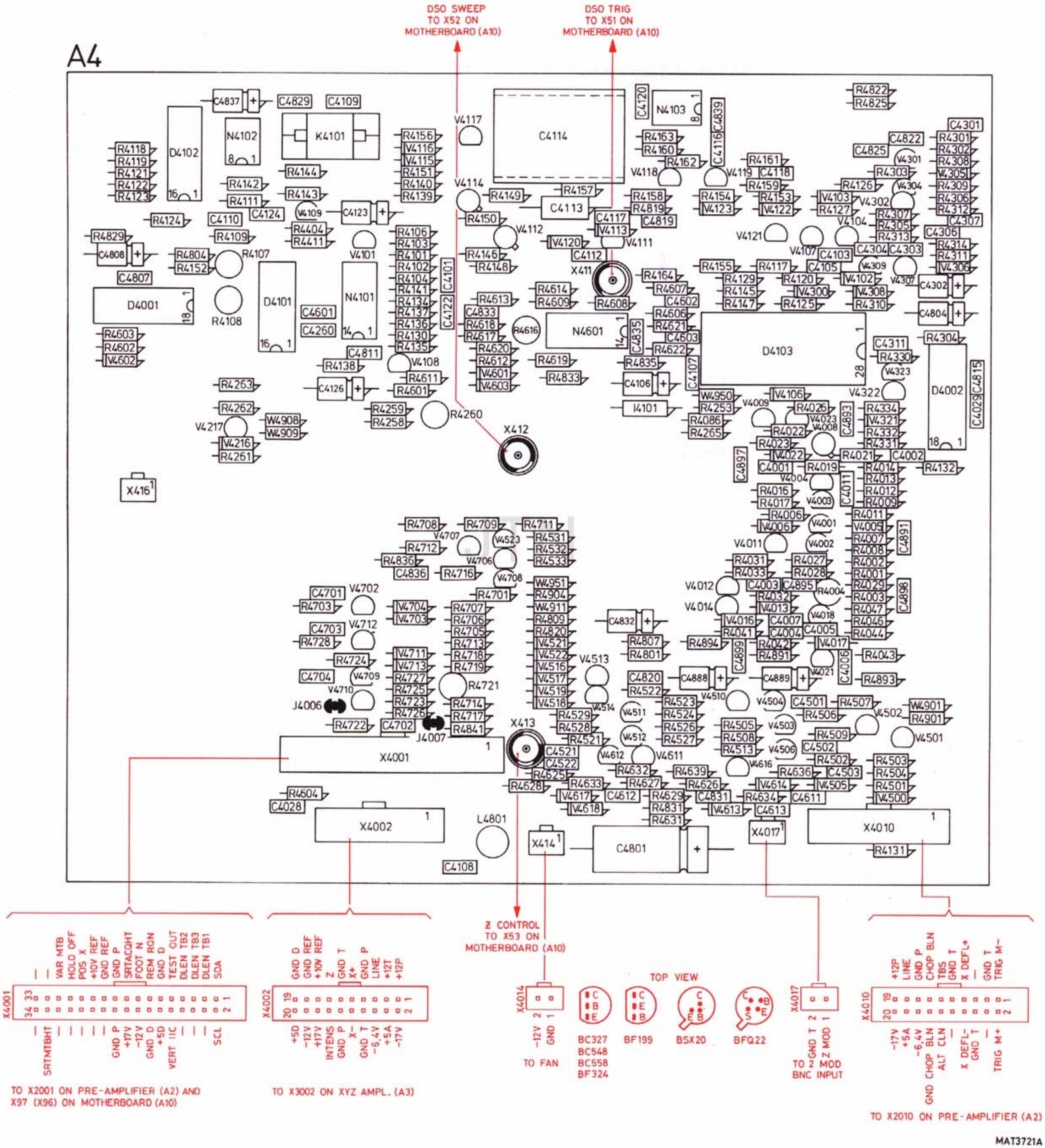
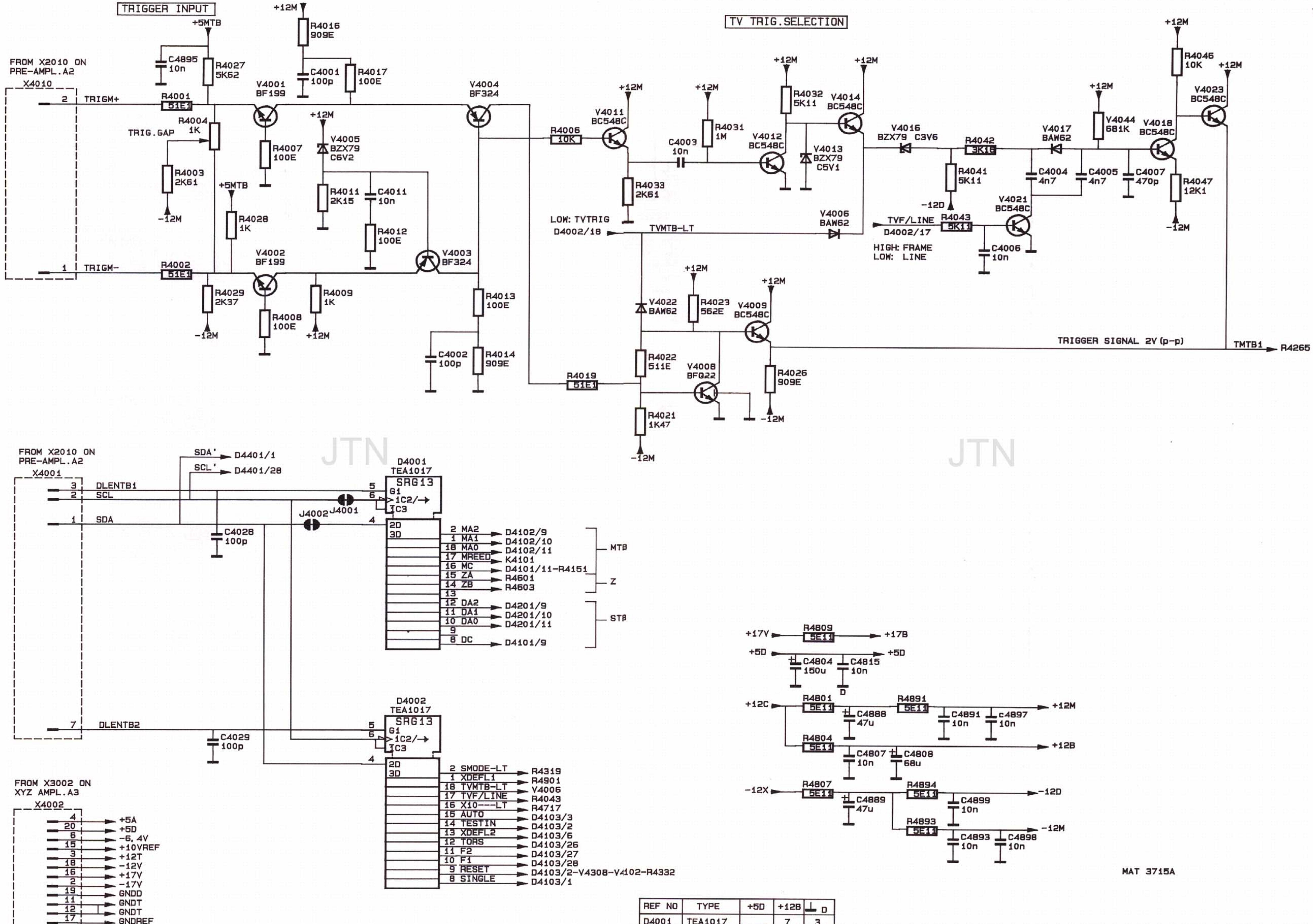
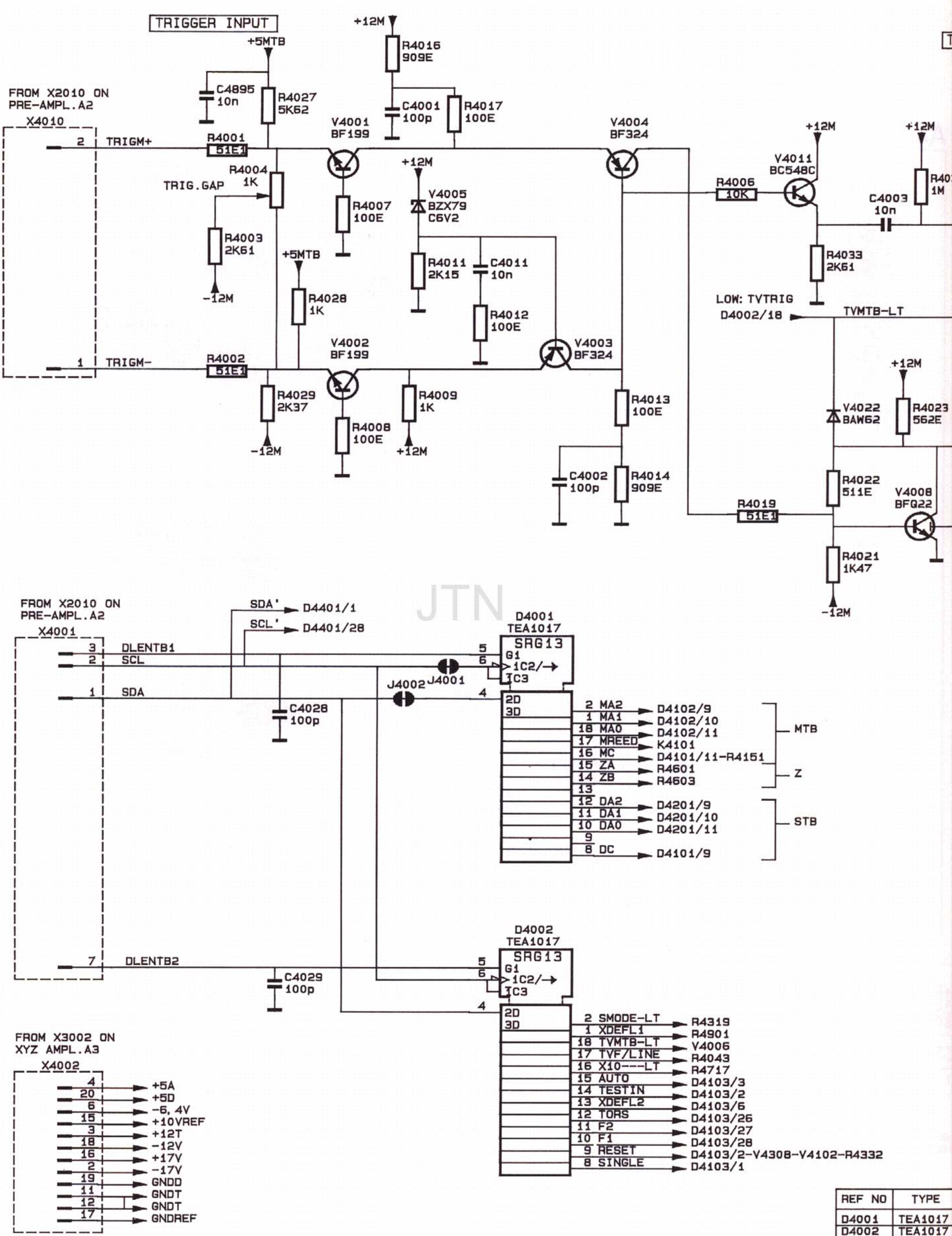


Figure 7.4 Time-base unit p.c.b.



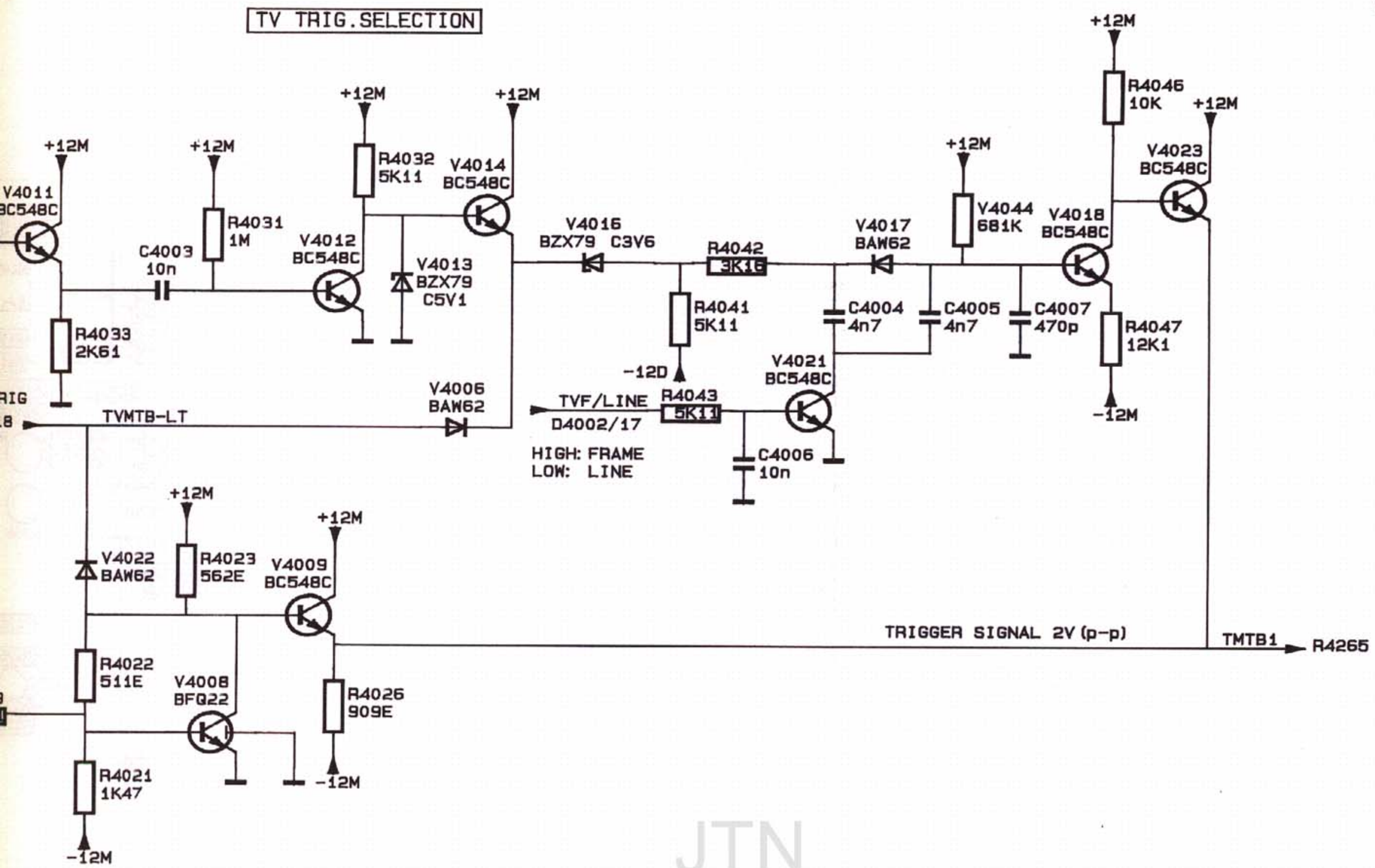
REF NO	TYPE	+5D	+12B	⊥ D
D4001	TEA1017		7	3
D4002	TEA1017	7		3
D4103	0Q0201			

Figure 7.5 Circuit diagram of time-base: trigger amplifier

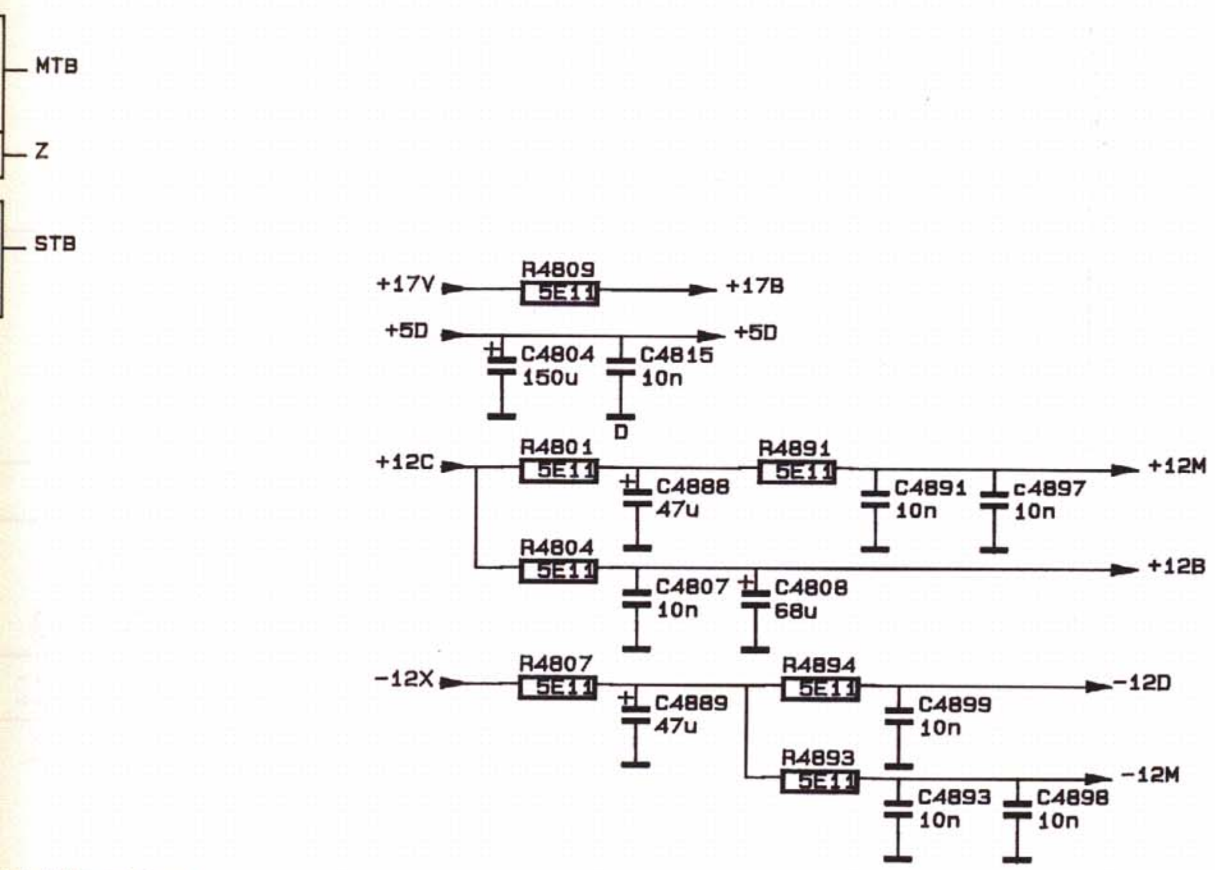


REF NO	TYPE
D4001	TEA1017
D4002	TEA1017
D4103	OQ0201

Figure 7.5 Circuit diagram of time-base: trigger amplifier



JTN



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REF NO	TYPE	+5D	+12B	⊥ D
D4001	TEA1017		7	3
D4002	TEA1017	7		3
D4103	OQ0201			

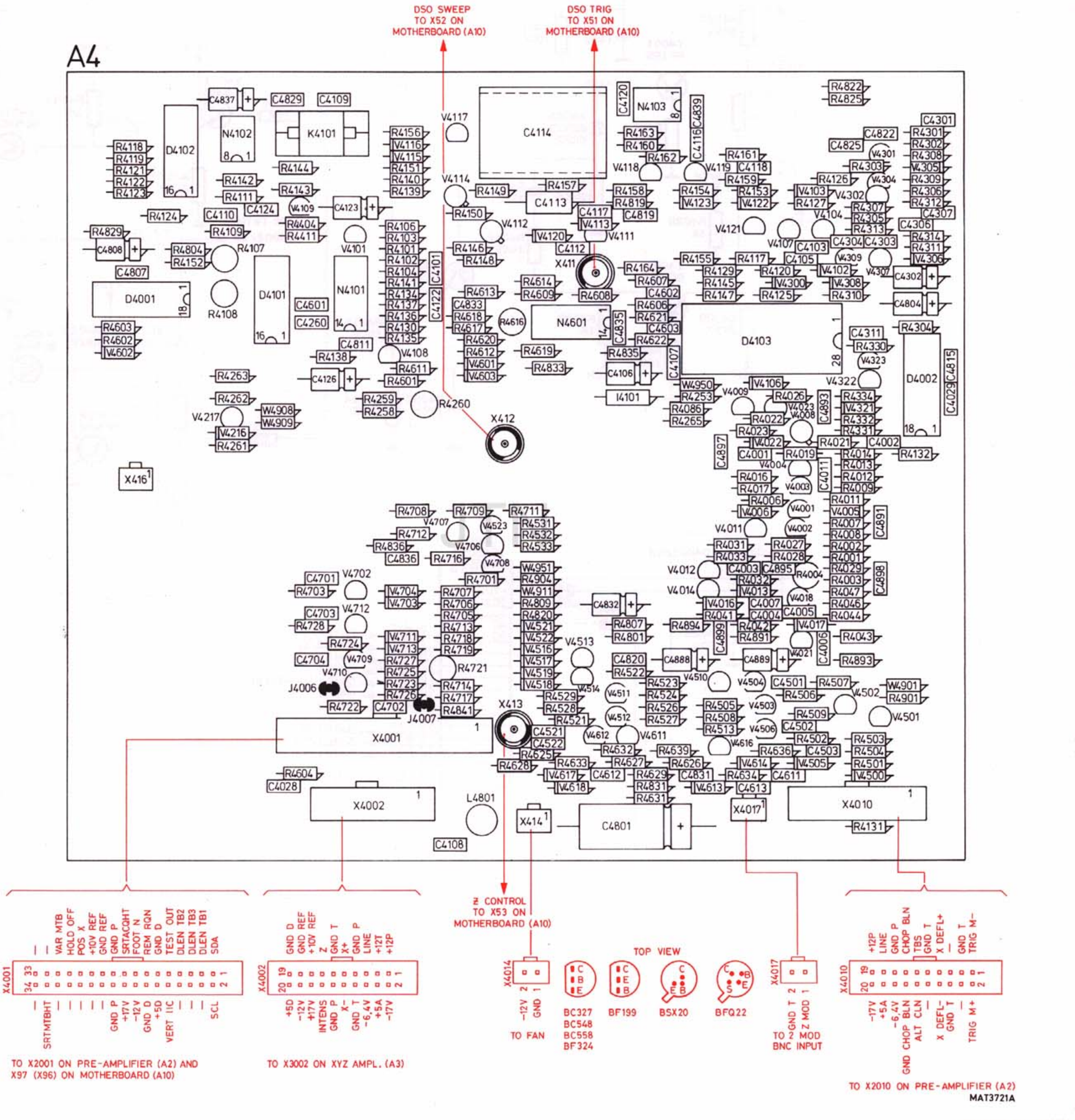
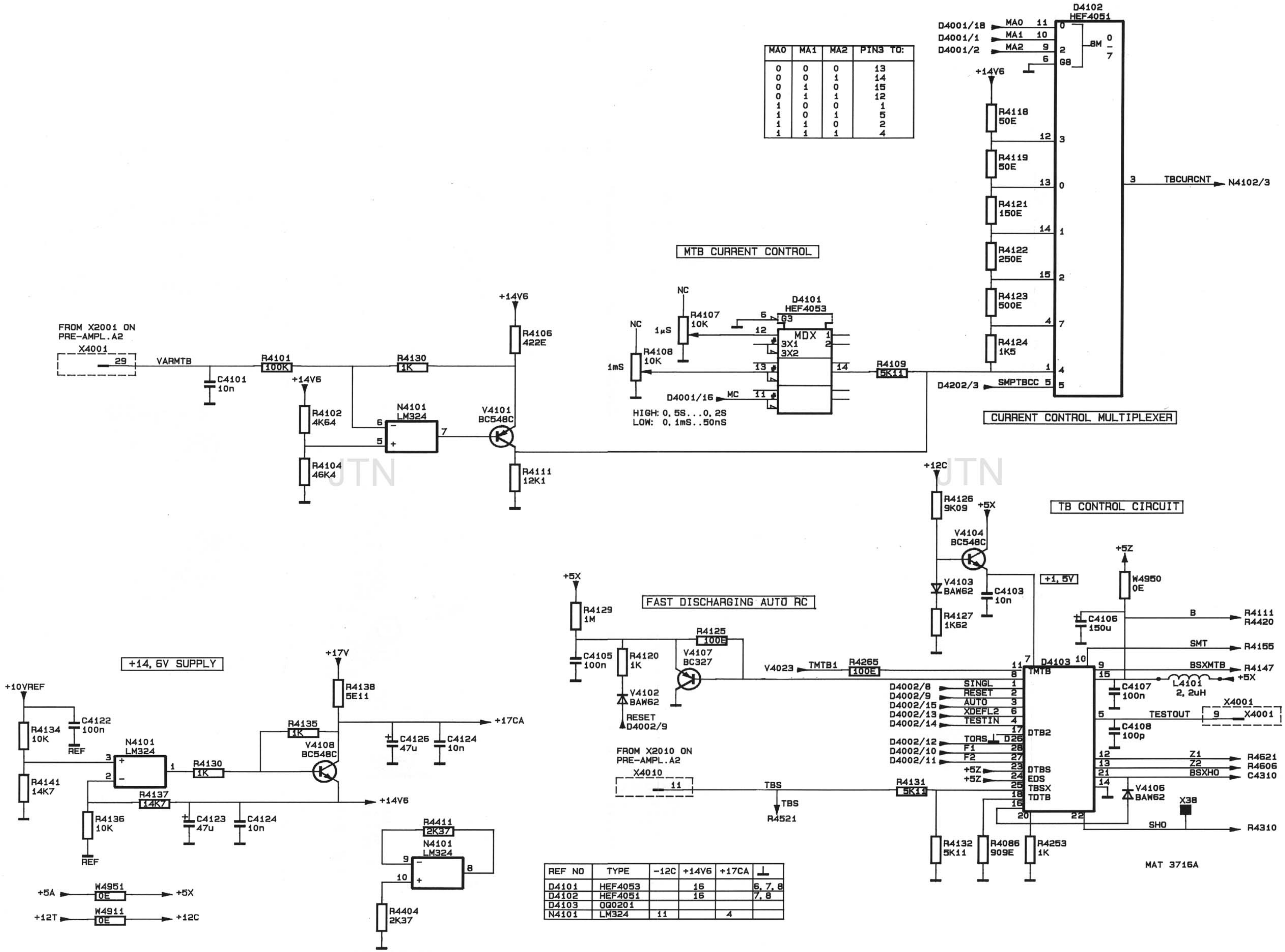


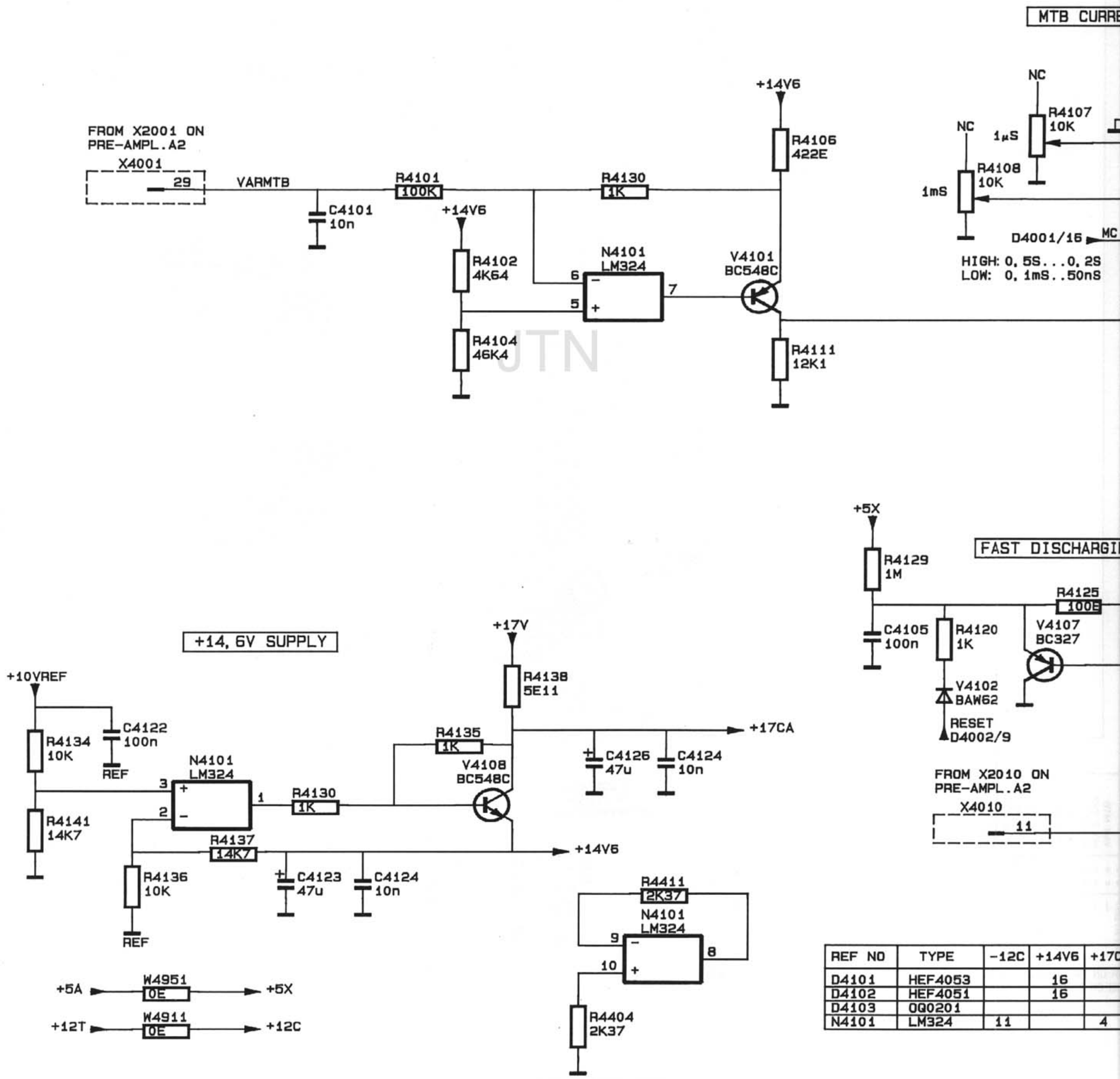
Figure 7.6 Time-base unit p.c.b.



MA0	MA1	MA2	PIN3 TO:
0	0	0	13
0	0	1	14
0	1	0	15
0	1	1	12
1	0	0	1
1	0	1	5
1	1	0	2
1	1	1	4

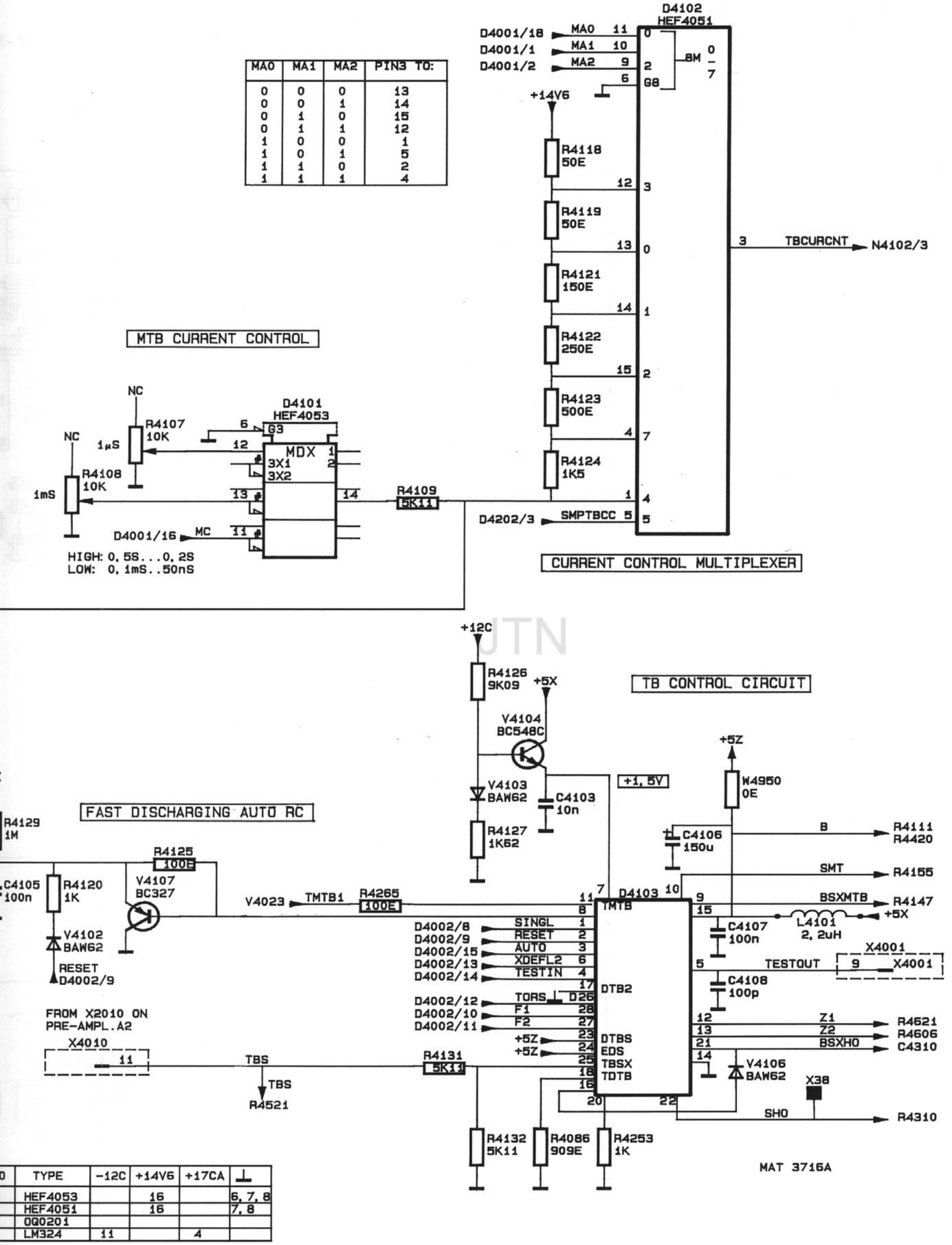
REF NO	TYPE	-12C	+14V6	+17CA	⊥
D4101	HEF4053		16		6, 7, 8
D4102	HEF4051		16		7, 8
D4103	OQ0201				
N4101	LM324	11		4	

Figure 7.7 Circuit diagram of time-base: TB control and TB current control



REF NO	TYPE	-12C	+14V6	+17C
D4101	HEF4053		16	
D4102	HEF4051		16	
D4103	0Q0201			
N4101	LM324	11		4

Figure 7.7 Circuit diagram of time-base: TB control and TB current control



MA0	MA1	MA2	PIN3 TO:
0	0	0	13
0	0	1	14
0	1	0	15
0	1	1	12
1	0	0	1
1	0	1	5
1	1	0	2
1	1	1	4

D	TYPE	-12C	+14V6	+17CA	⊥
	HEF4053		16		6, 7, 8
	HEF4051		16		7, 8
	OQ0201				
	LM324	11		4	

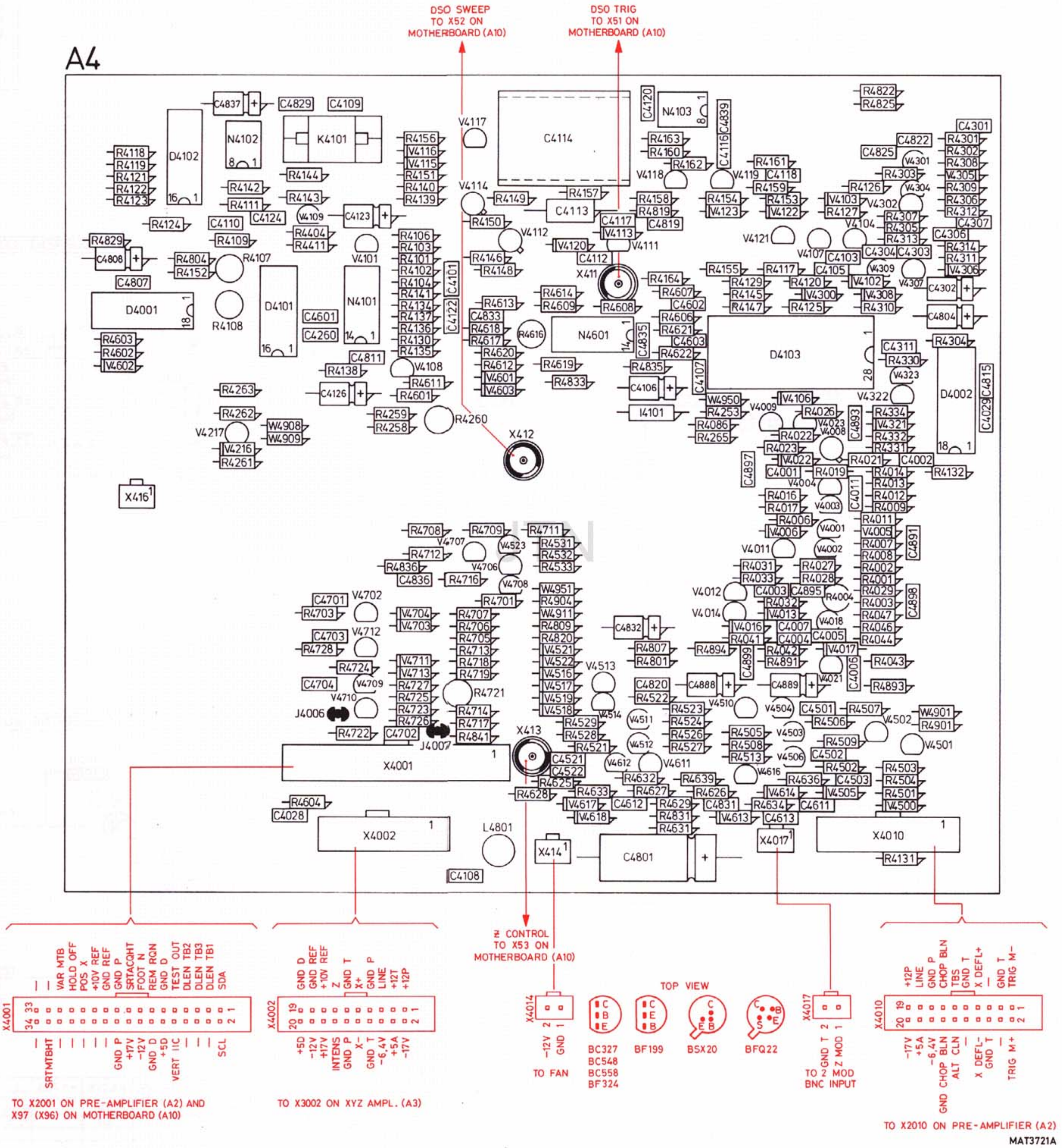
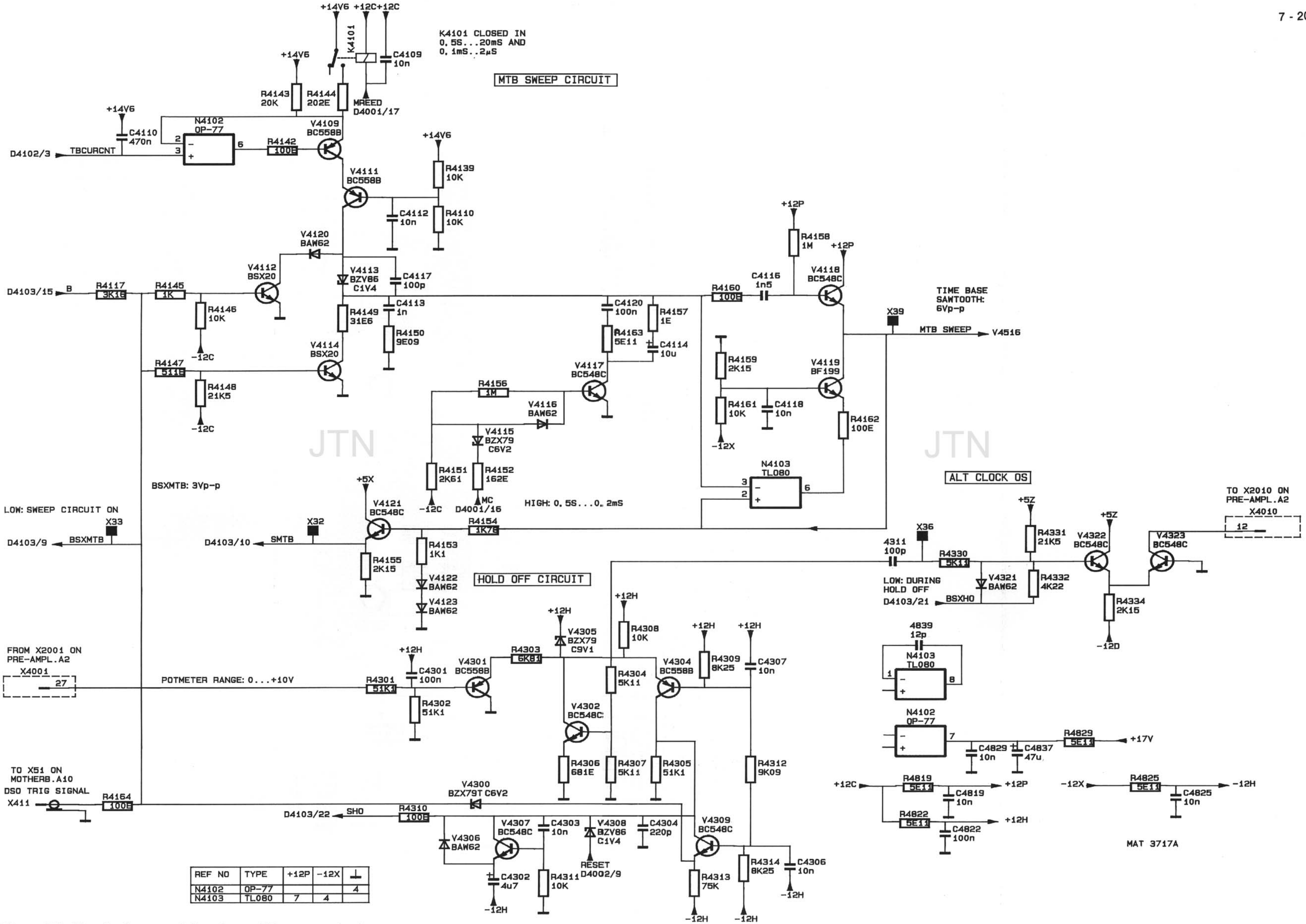
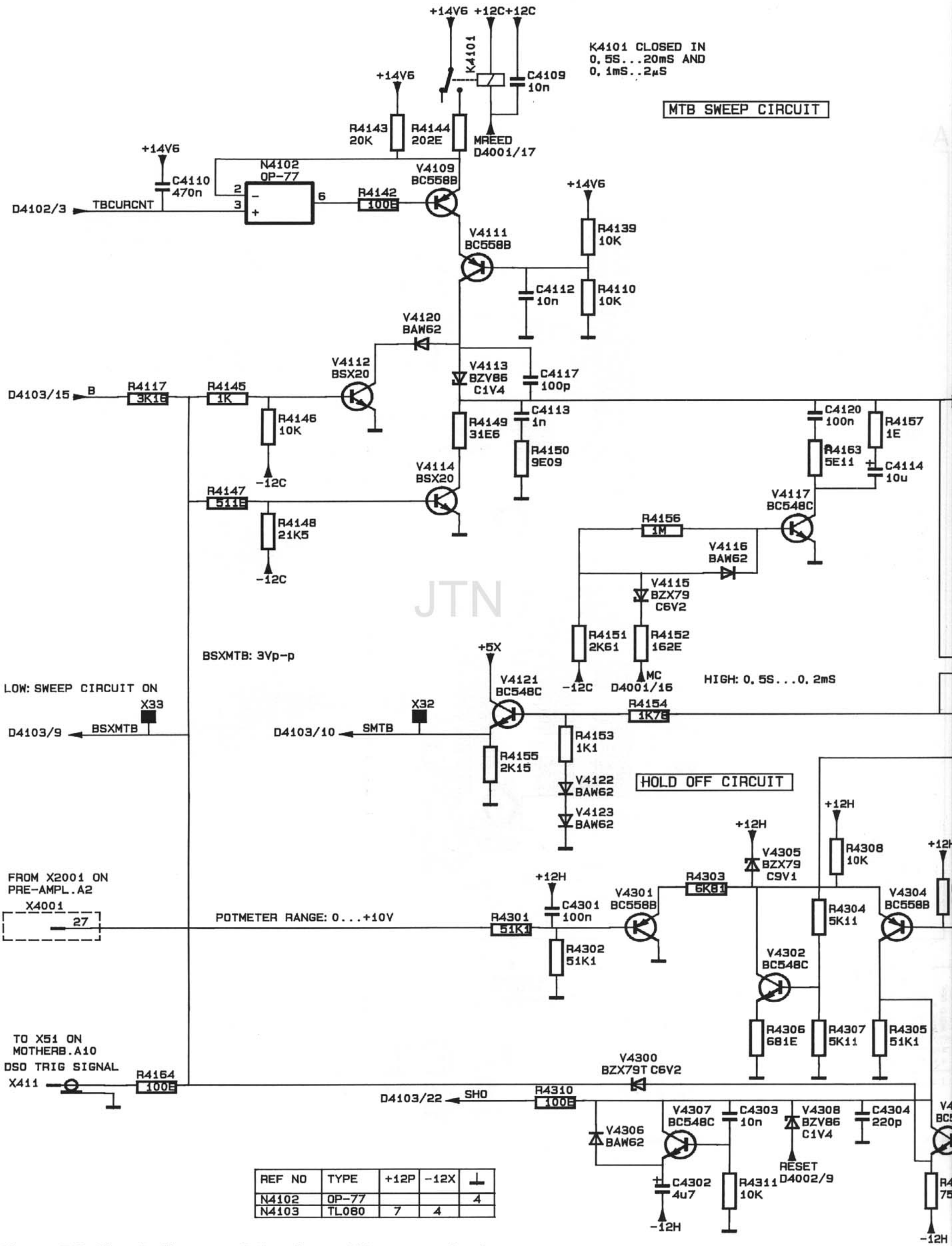


Figure 7.8 Time base unit p.c.b.



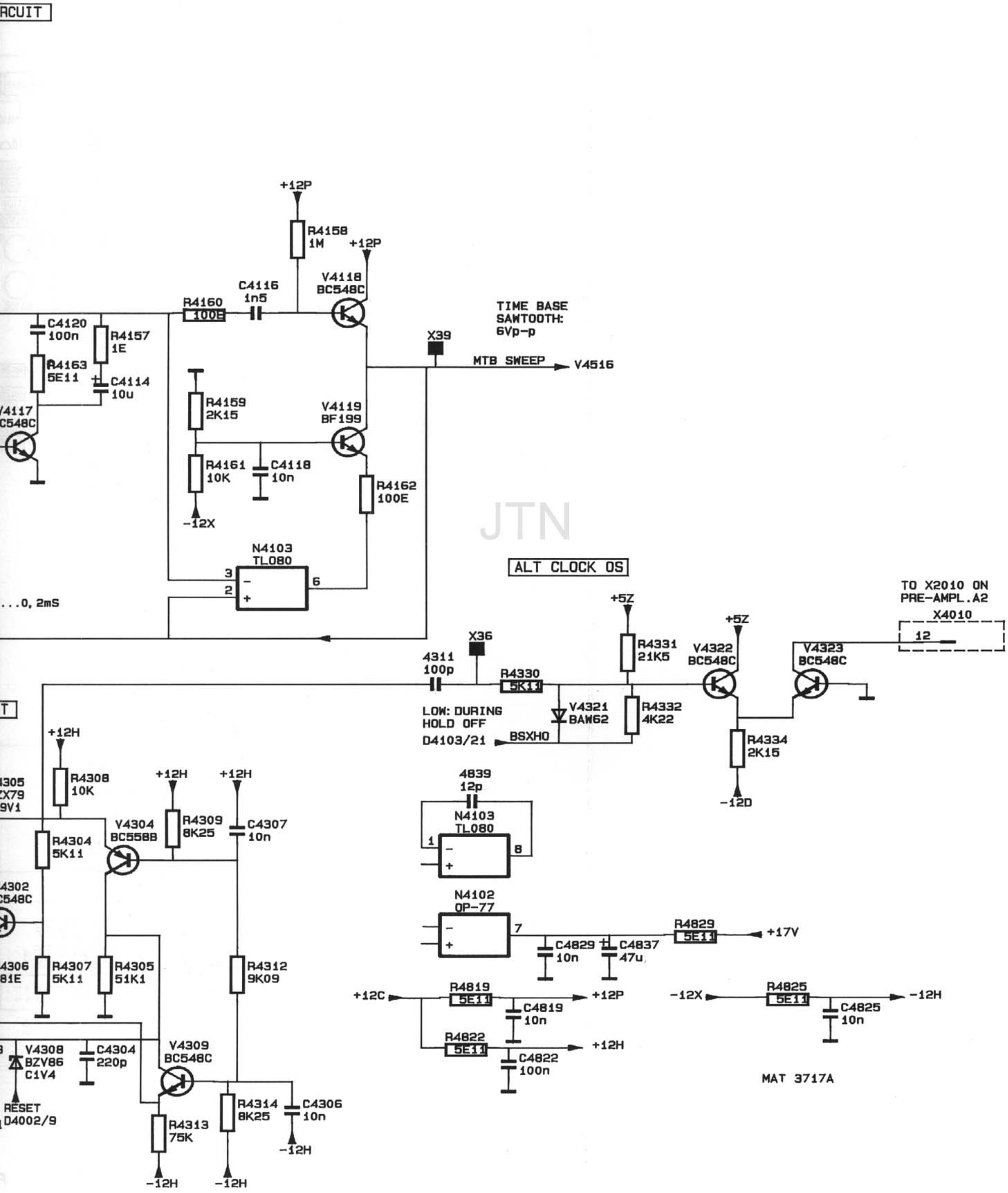
REF NO	TYPE	+12P	-12X	⊥
N4102	OP-77			4
N4103	TL080	7	4	

Figure 7.9 Circuit diagram of time-base: TB sweep circuit



REF NO	TYPE	+12P	−12X	⊥
N4102	OP-77			4
N4103	TL080	7	4	

Figure 7.9 Circuit diagram of time-base: TB sweep circuit


RCUIT
+12P
R4158
1M
+12P
C4116
1n5
V4118
BC548C
R4160
100E
C4120
100n
R4157
1E
R4163
5E11
C4114
10u
TIME BASE
SAWTOOTH:
6Vp-p
X39
MTB SWEEP
V4516
V4117
C548C
R4159
2K15
V4119
BF199
R4161
10K
C4118
10n
R4162
100E
-12X
N4103
TL080
ALT CLOCK OS
...0, 2mS
TO X2010 ON
PRE-AMPL.A2
X4010
12
+5Z
+5Z
R4331
21K5
V4322
BC548C
V4323
BC548C
X36
4311
100p
R4330
5K11
LOW: DURING
HOLD OFF
D4103/21
BSXHO
V4321
BAW62
R4332
4K22
R4334
2K15
-12D
+12H
R4308
10K
+12H
+12H
4305
ZX79
9V1
V4304
BC558B
R4309
8K25
C4307
10n
R4304
5K11
4839
12p
N4103
TL080
4302
C548C
N4102
OP-77
R4829
5E11
+17V
C4829
10n
C4837
47u
4306
81E
R4307
5K11
R4305
51K1
R4312
9K09
+12C
R4819
5E11
+12P
C4819
10n
-12X
R4825
5E11
-12H
C4825
10n
R4822
5E11
+12H
C4822
100n
V4308
BZV86
C1V4
C4304
220p
V4309
BC548C
RESET
D4002/9
R4313
75K
R4314
8K25
C4306
10n
-12H
-12H
-12H
MAT 3717A

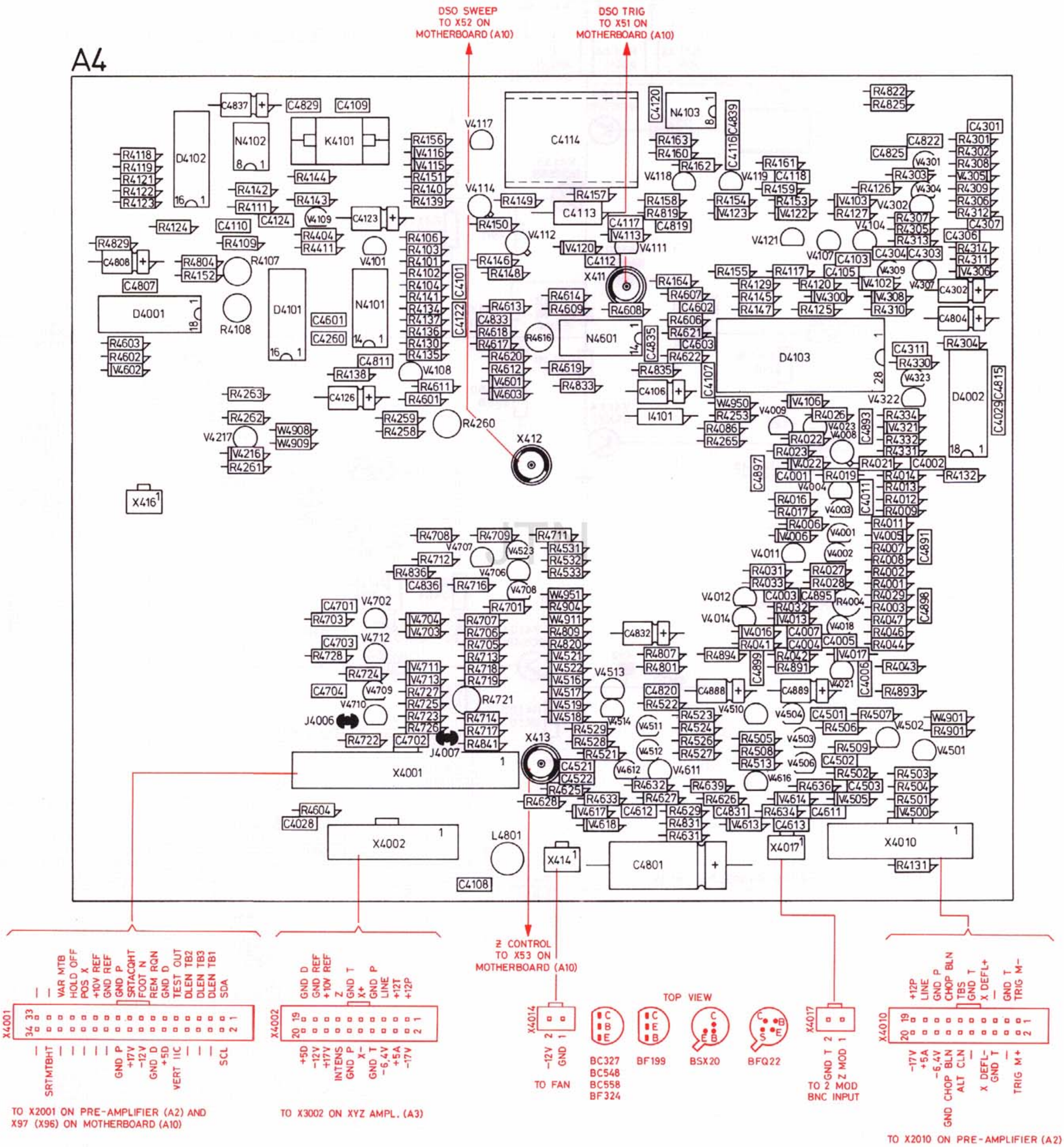


Figure 7.10 Time-base unit p.c.b.

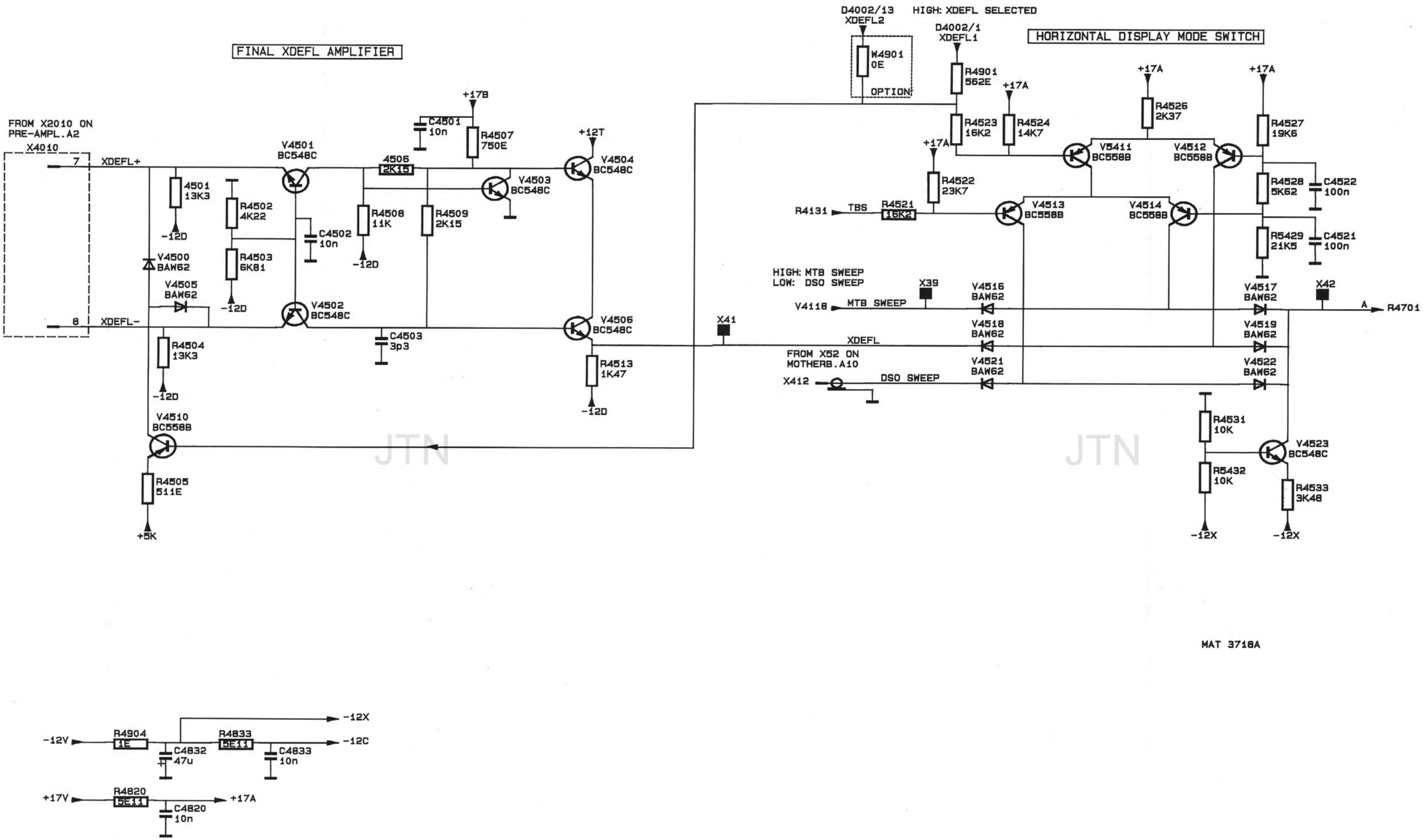


Figure 7.11 Circuit diagram of time-base: final XDEFL-amplifier

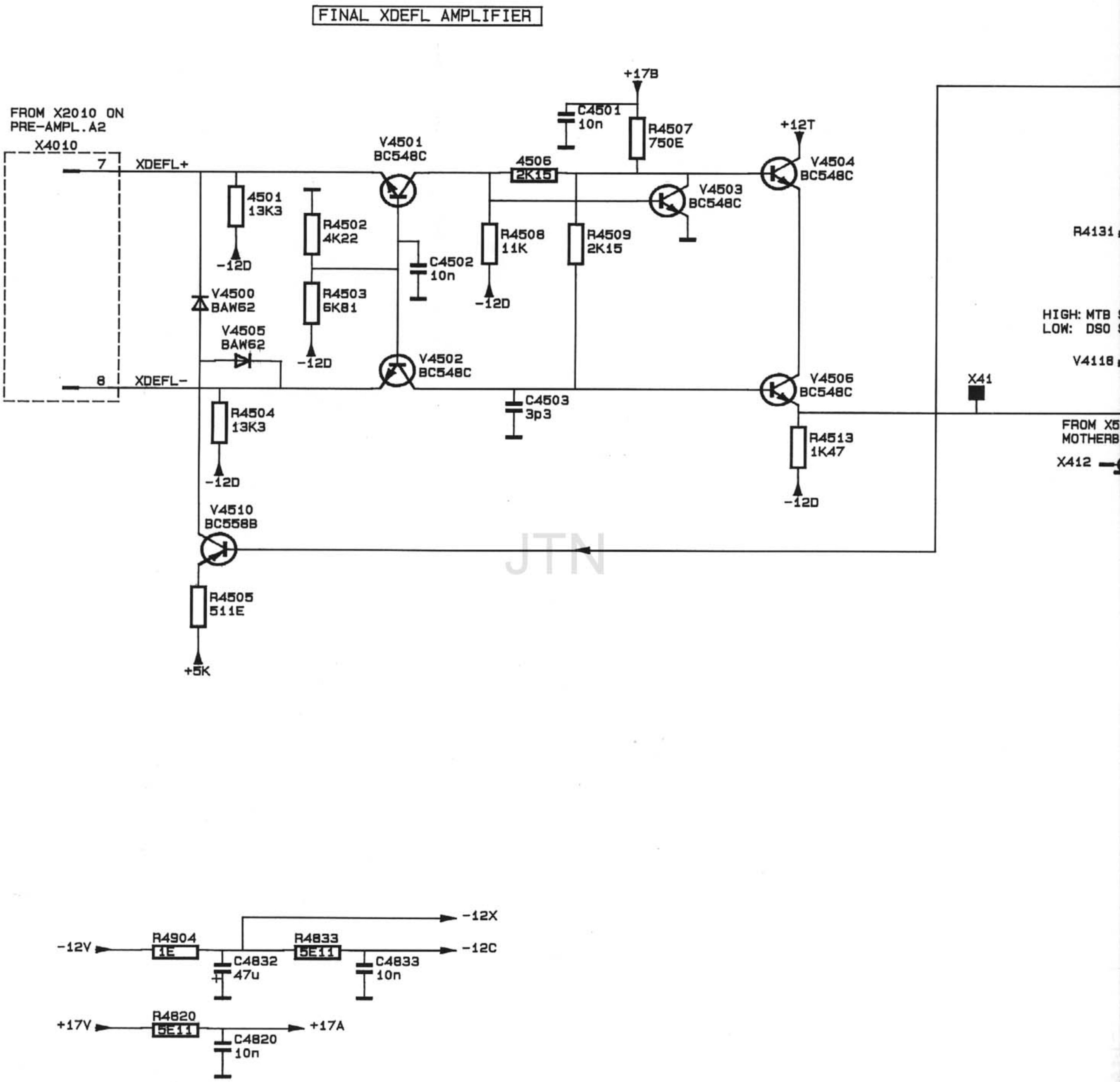
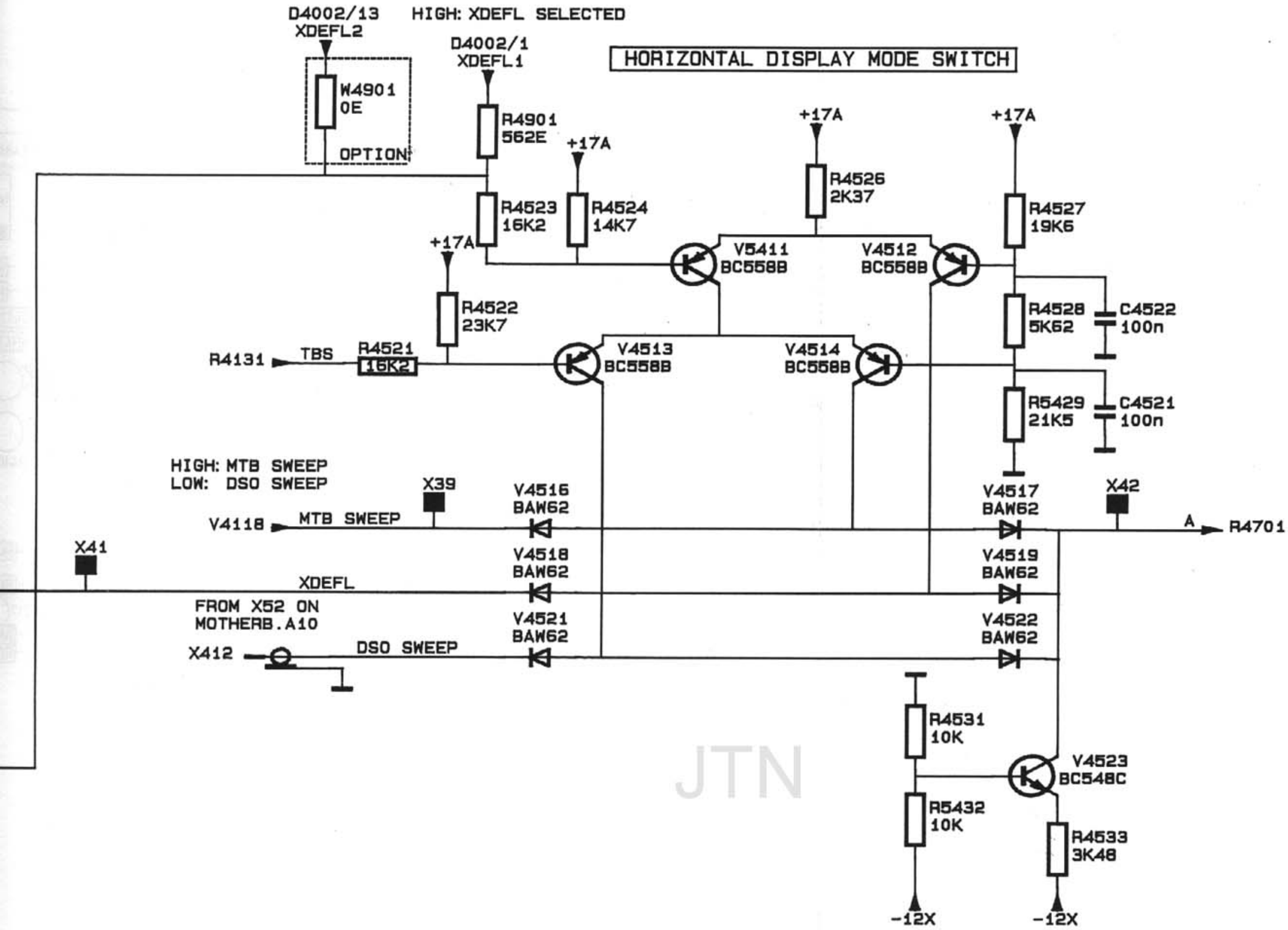


Figure 7.11 Circuit diagram of time-base: final XDEFL-amplifier


HORIZONTAL DISPLAY MODE SWITCH
D4002/13
XDEFL2
HIGH: XDEFL SELECTED
D4002/1
XDEFL1
W4901
0E
OPTION
R4901
562E
+17A
R4523
16K2
R4524
14K7
R4526
2K37
R4527
19K6
V5411
BC558B
V4512
BC558B
R4522
23K7
R4131
TBS
R4521
16K2
V4513
BC558B
V4514
BC558B
R4528
5K62
C4522
100n
R5429
21K5
C4521
100n
HIGH: MTB SWEEP
LOW: DSO SWEEP
X39
V4516
BAW62
V4517
BAW62
X42
V4118
MTB SWEEP
A
R4701
X41
V4518
BAW62
V4519
BAW62
XDEFL
FROM X52 ON
MOTHERB.A10
V4521
BAW62
V4522
BAW62
X412
DSO SWEEP
R4531
10K
V4523
BC548C
R5432
10K
R4533
3K48
-12X

MAT 3718A

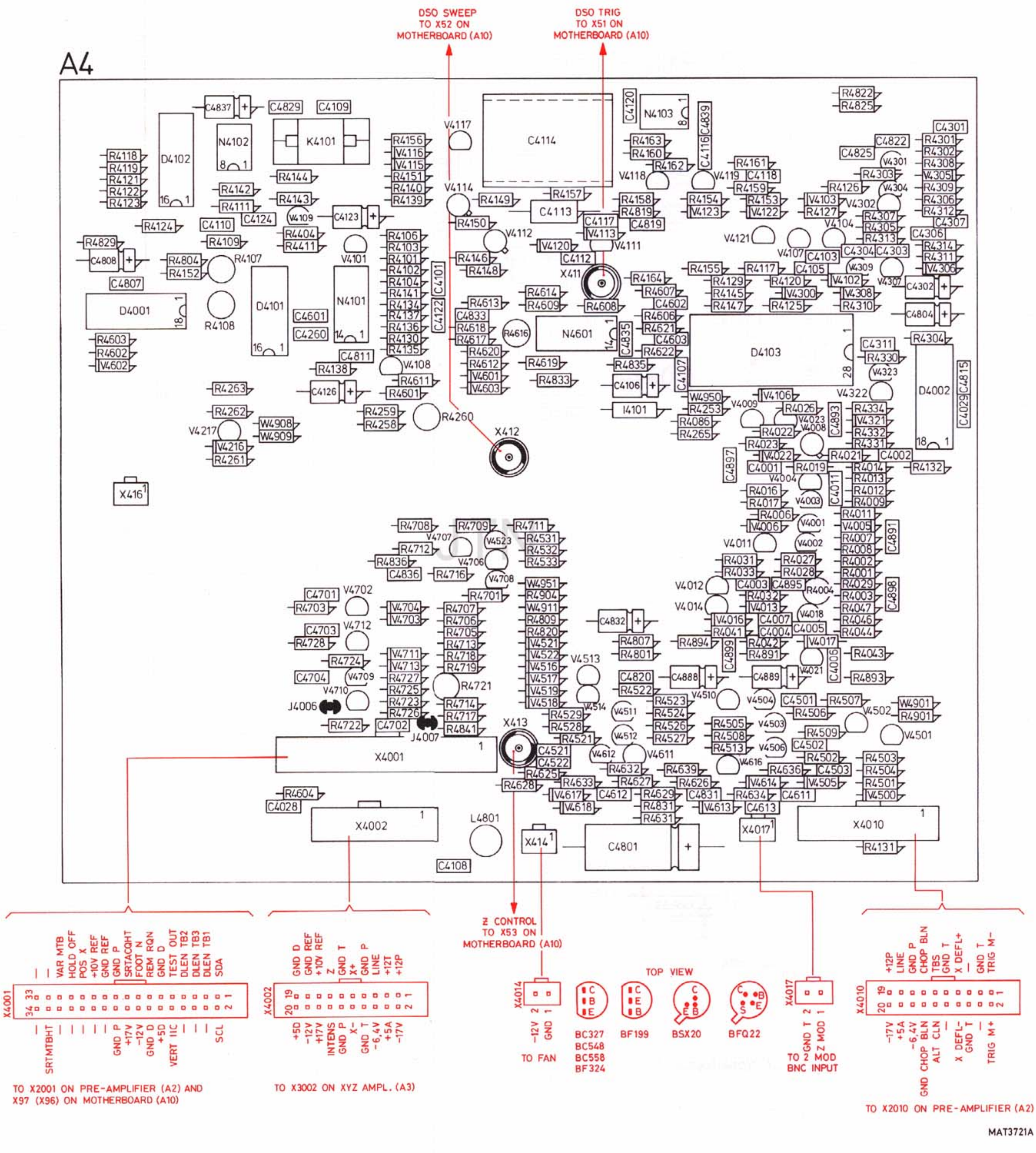
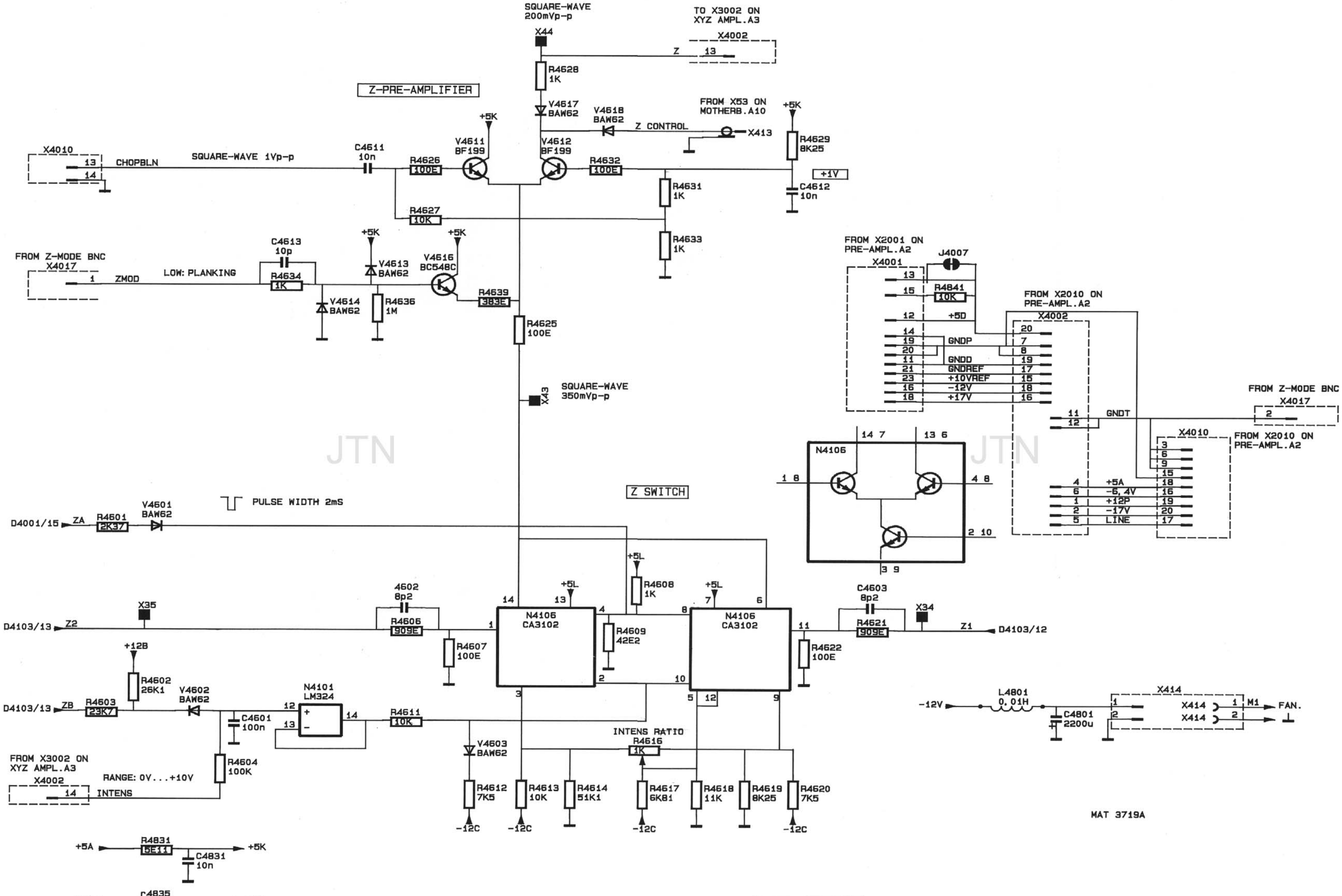


Figure 7.12 Time-base unit p.c.b.



REF NO	TYPE
N4101	LM324
N4601	CA3101

Figure 7.13 Circuit diagram of time-base unit: Z pre-amplifier and Z switch

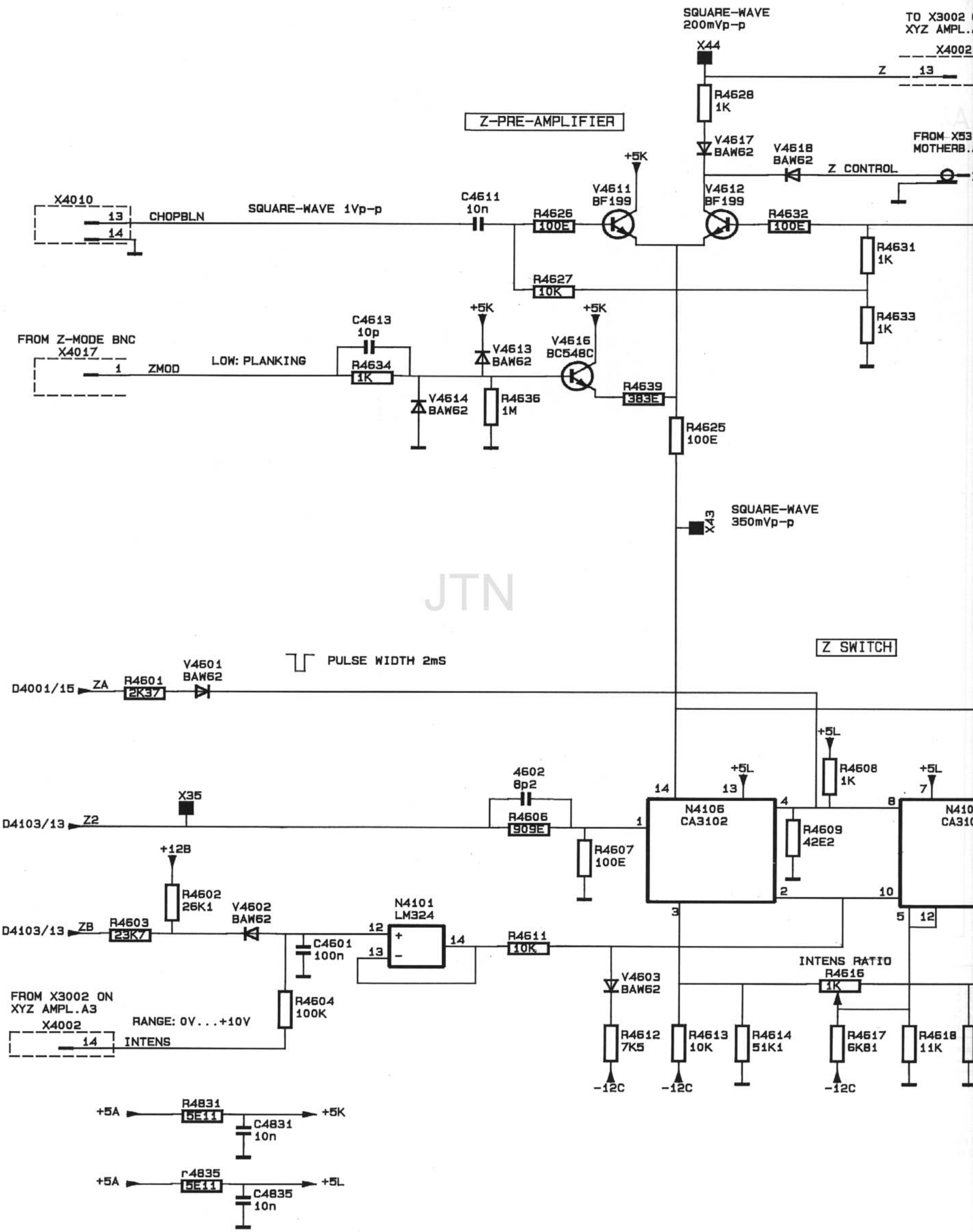
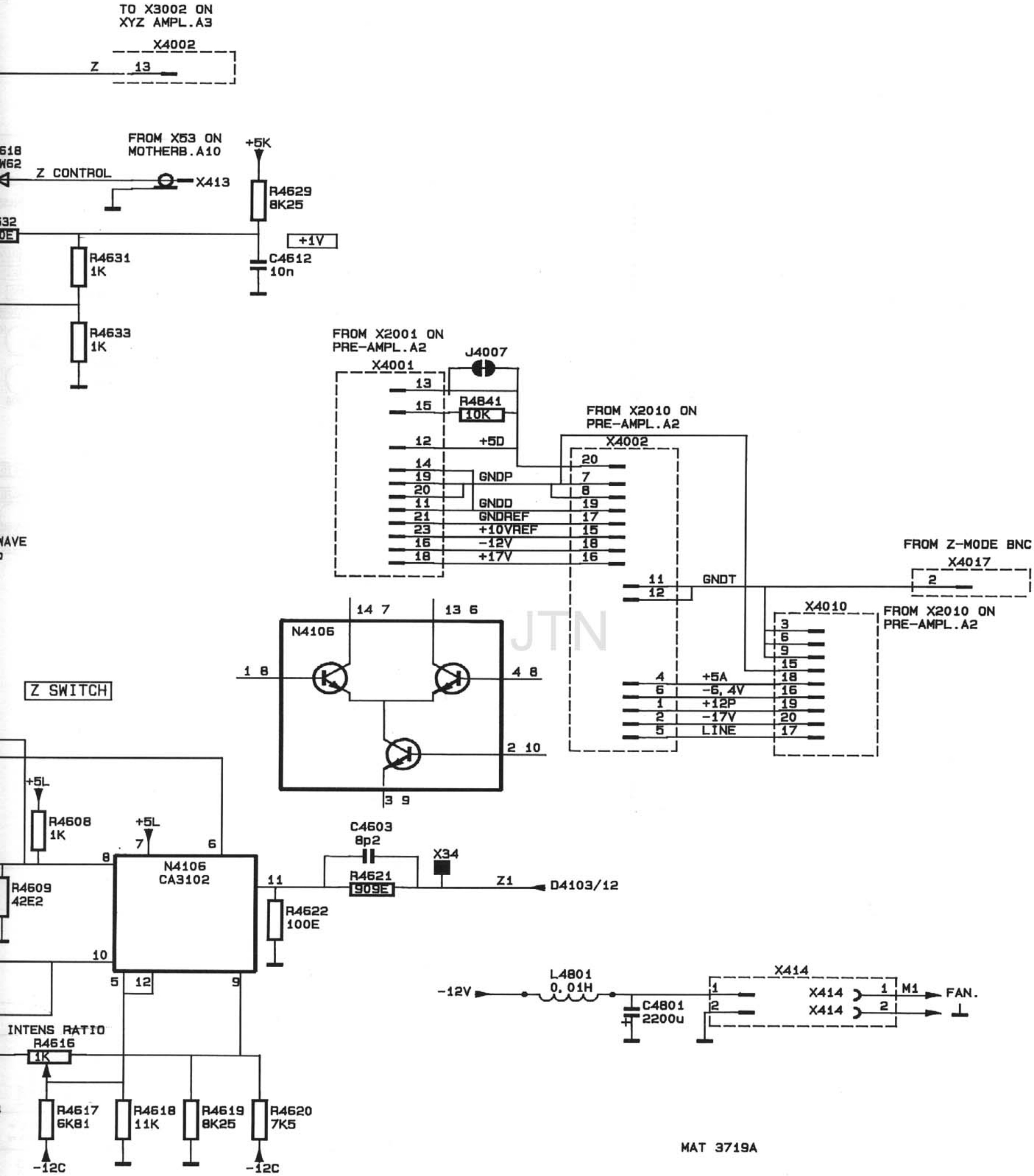


Figure 7.13 Circuit diagram of time-base unit: Z pre-amplifier and Z switch



REF NO	TYPE
N4101	LM324
N4601	CA3101

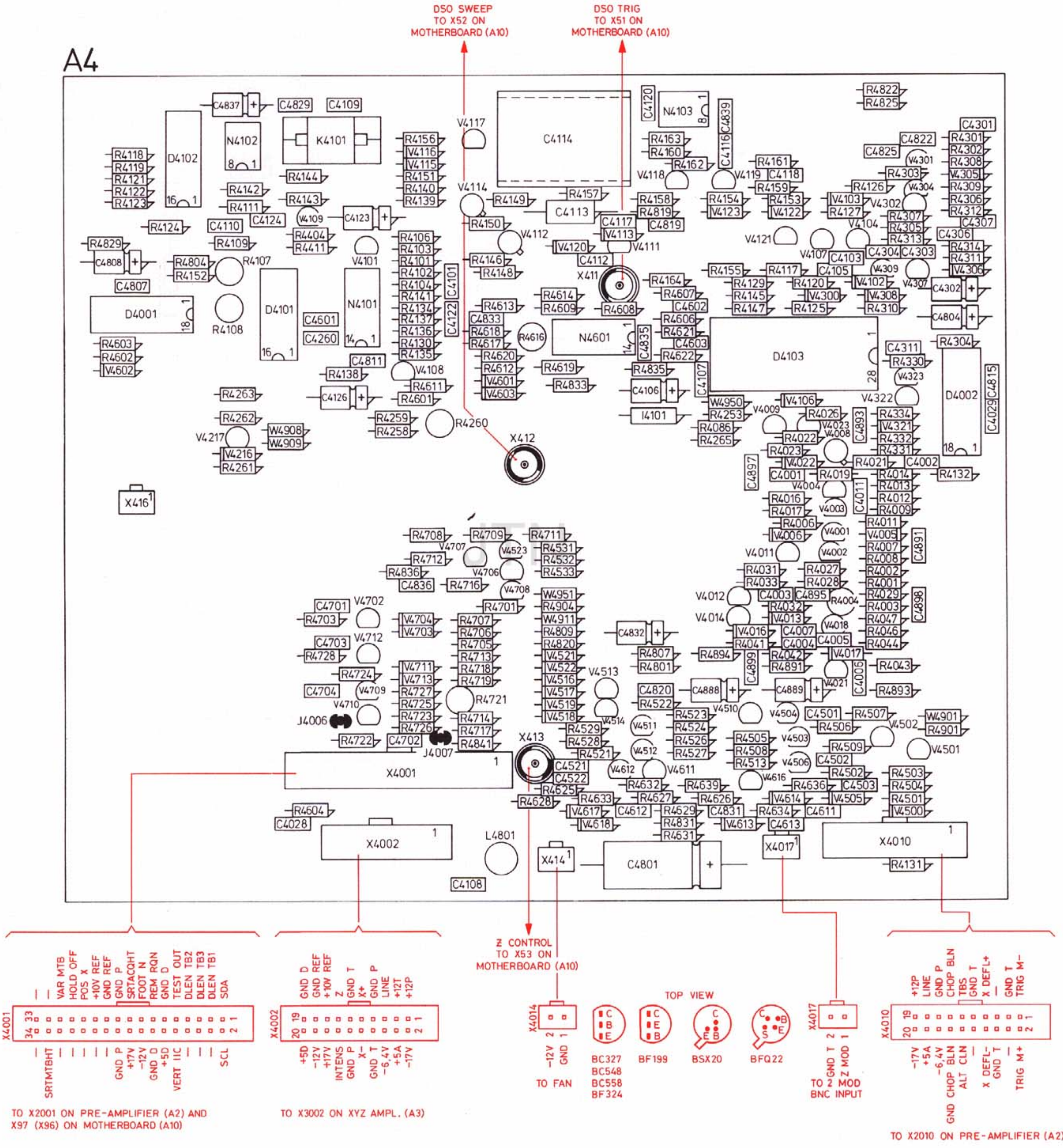
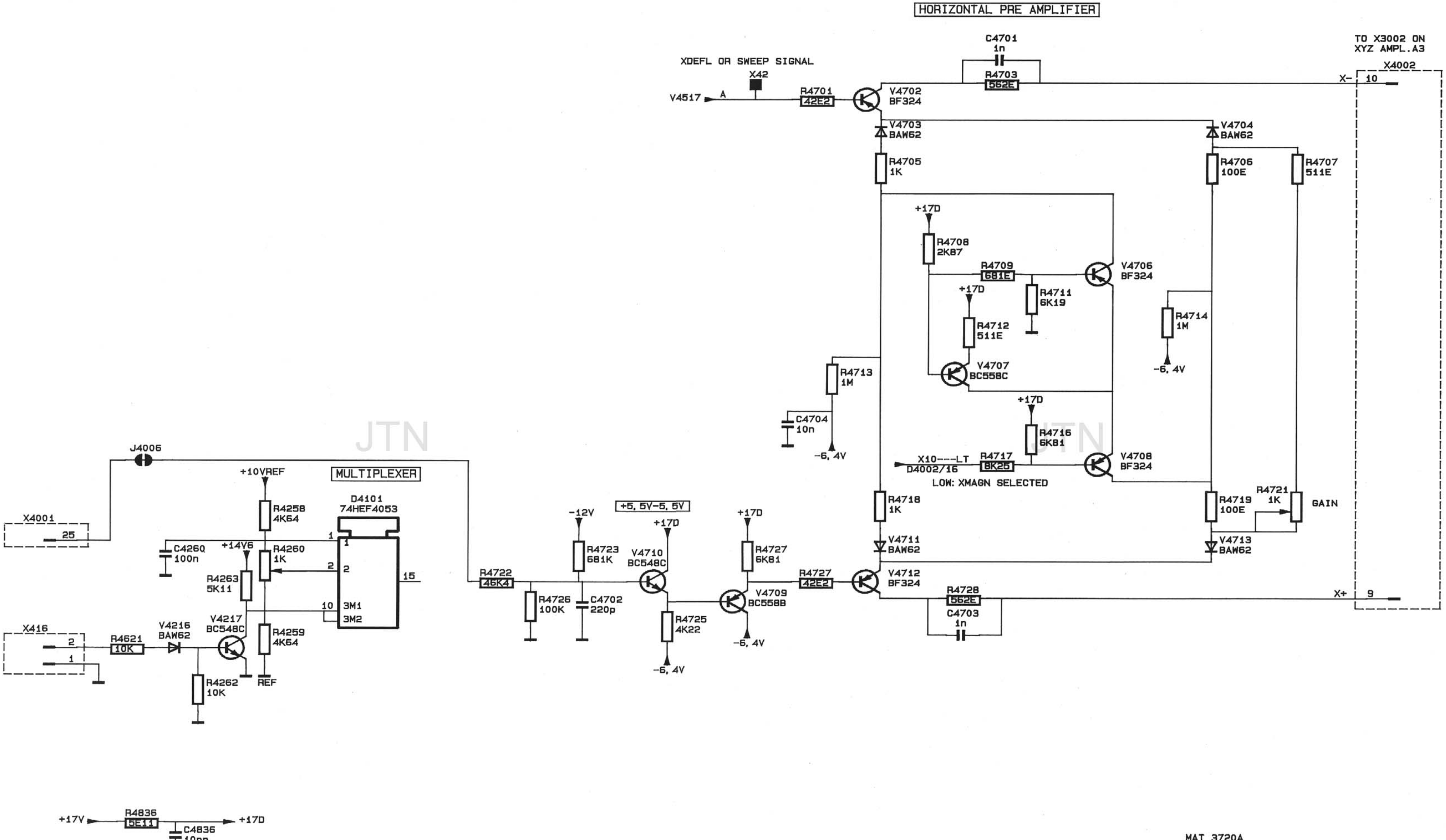
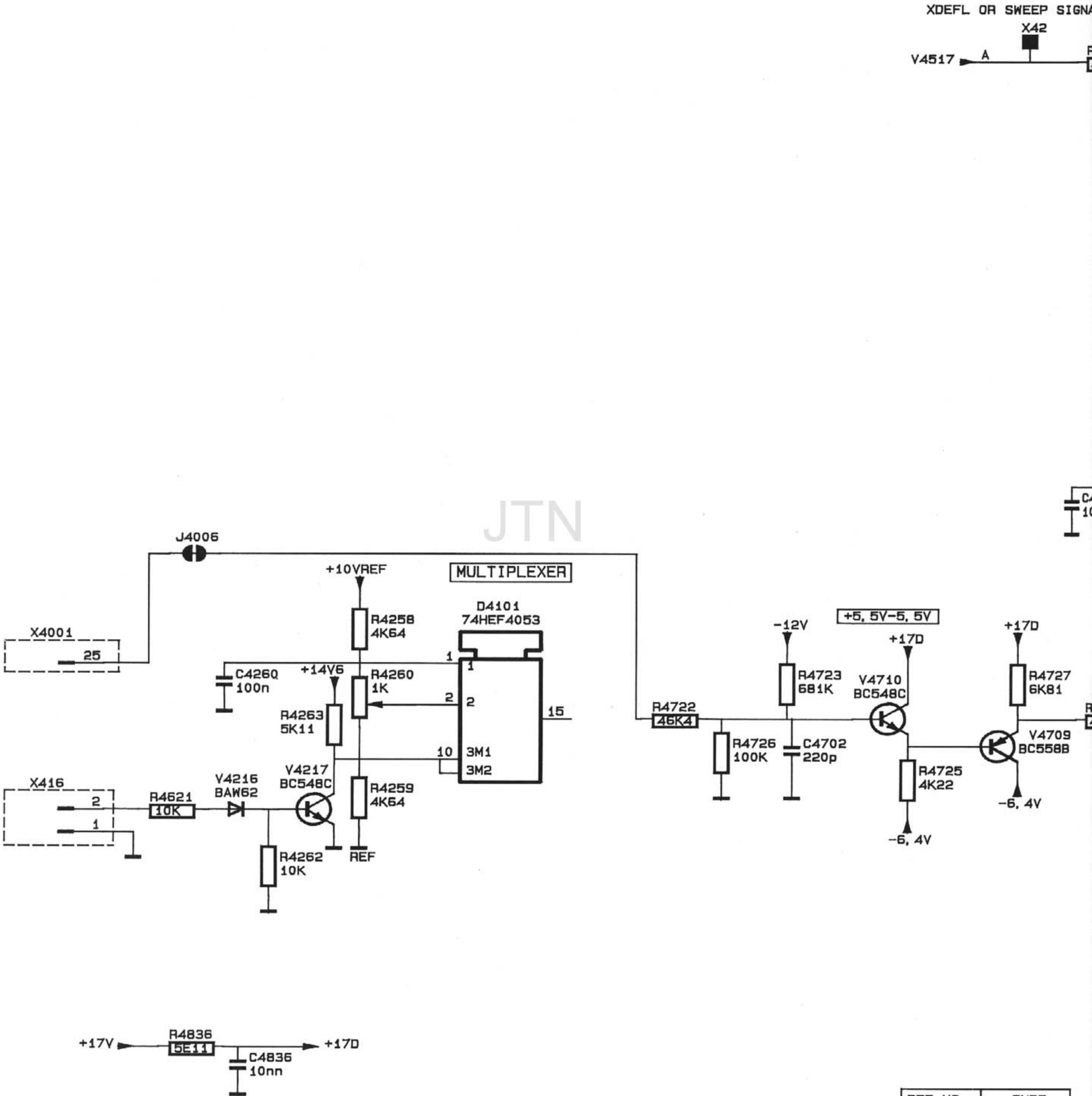


Figure 7.14 Time-base unit p.c.b



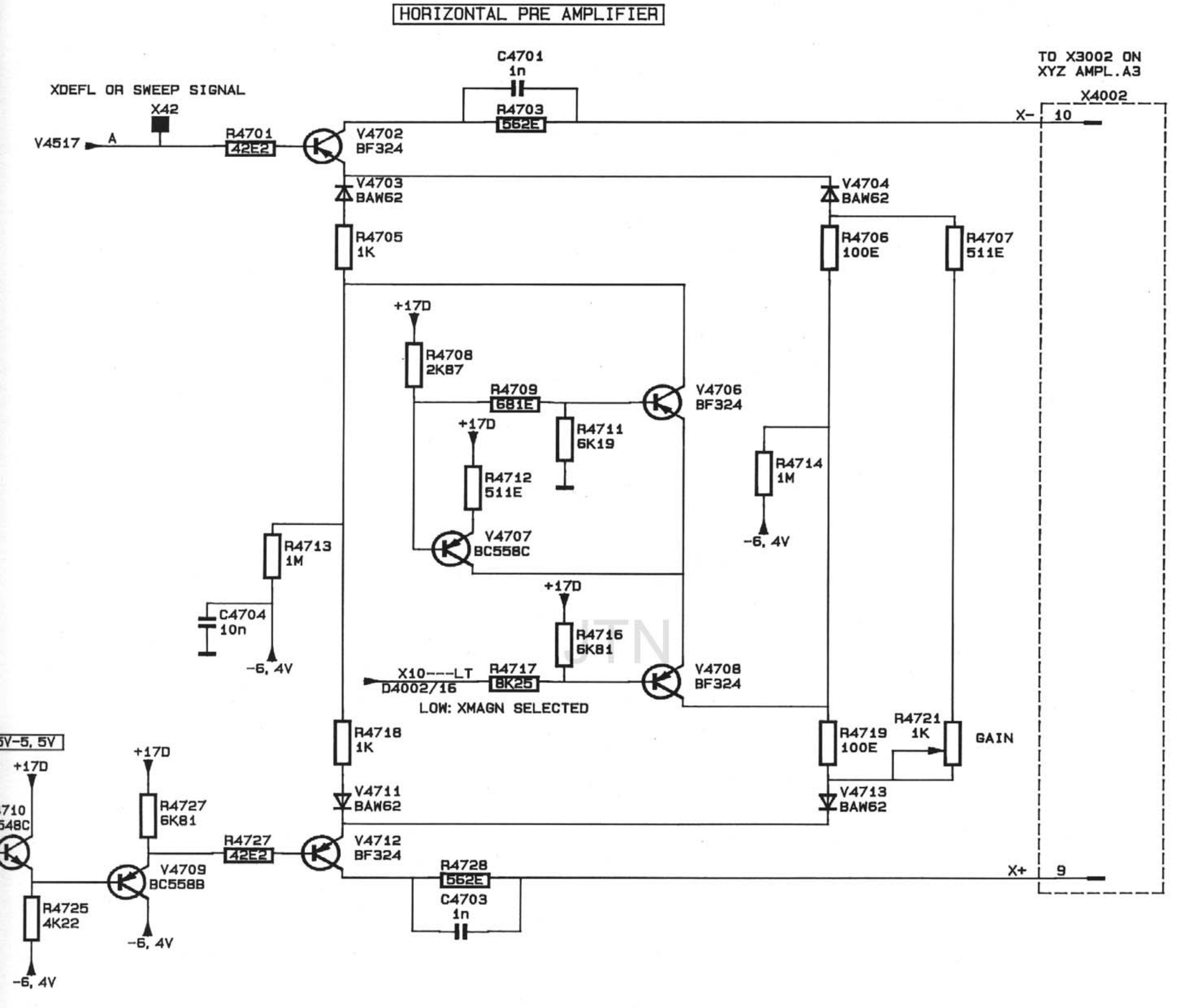
REF NO	TYPE
D4101	HEF4053

Figure 7.15 Circuit diagram of time-base: Horizontal pre-amplifier



REF NO	TYPE
D4101	HEF4053

Figure 7.15 Circuit diagram of time-base: Horizontal pre-amplifier



MAT 3720A

REF NO	TYPE
D4101	HEF4053

8 CRT CONTROL UNIT (A5)

This unit incorporates the potentiometers that control the CRT functions. These potentiometers are INTENS (R1), screwdriver operated control TRACE ROT (R2), FOCUS (R3) and ILLUM (R4).
The range of these potentiometers is between 0 V and + 10 V.
The way these potentiometers influence the associated circuits is described together with the description of the relevant circuit part.

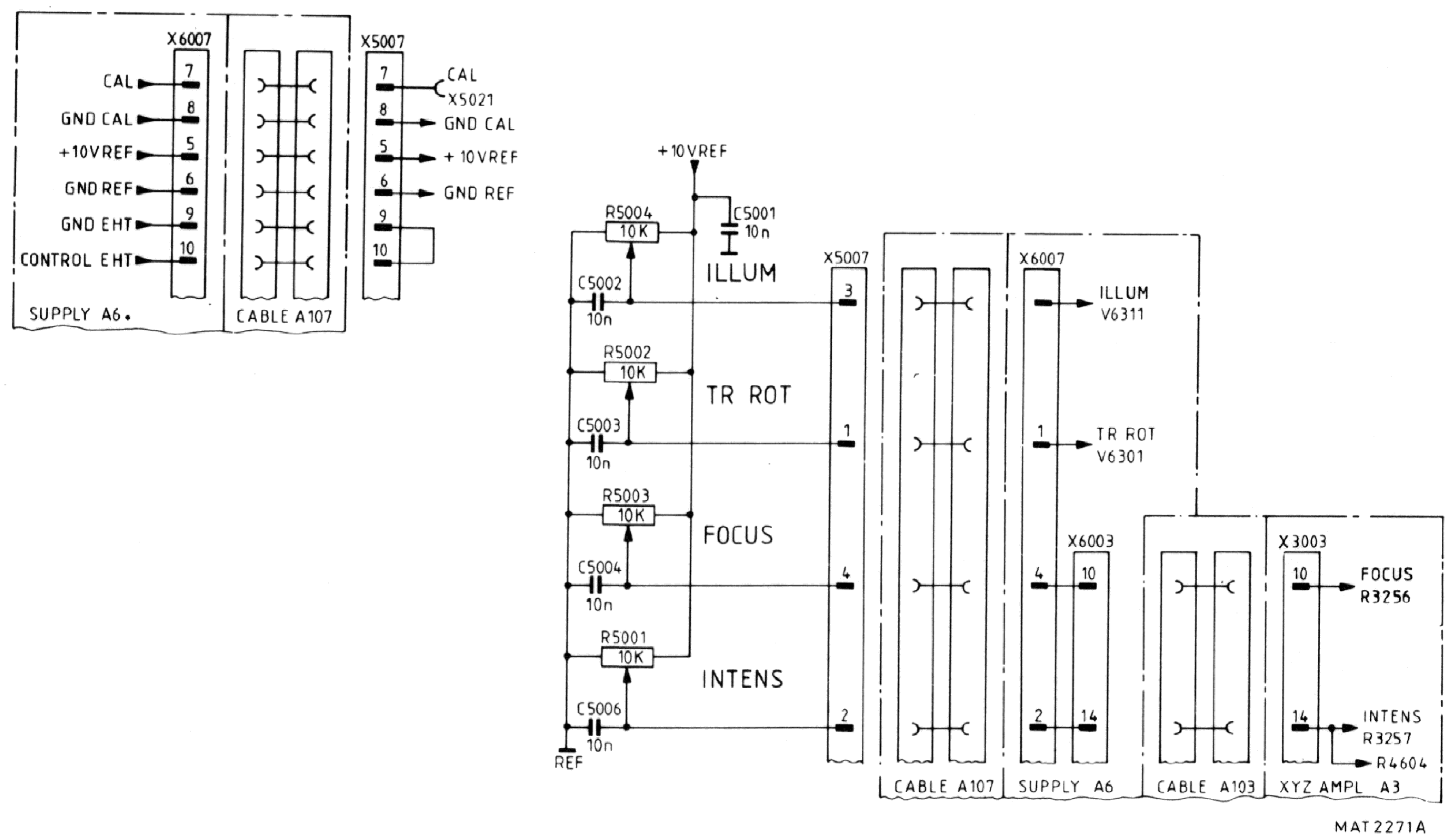


Figure 8.1 Circuit diagram of CRT control

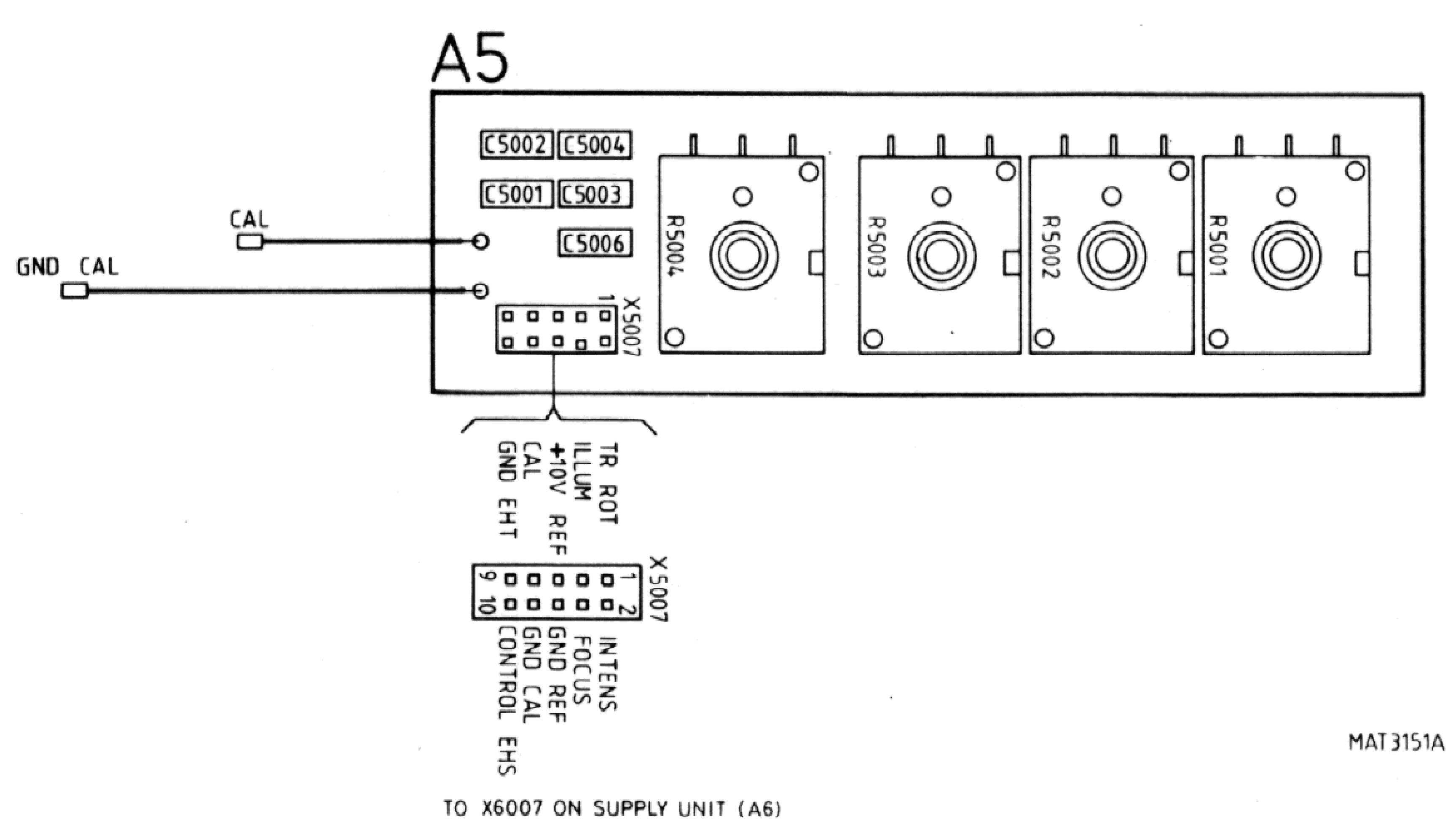


Figure 8.2 CRT control unit p.c.b.

9 POWER SUPPLY UNIT (A6)

Basically, the power supply unit consists of:

- input circuit
- converter circuit
- secondary output rectifiers
- HT supply
- CAL oscillator
- CRT control circuit

9.1 INPUT CIRCUIT

The instrument may be powered from a nominal mains voltage of 90 V...264 V a.c.
The mains voltage is primary protected by a fuse of 1,6 AT, which is located on the rear of the instrument.

After rectification by the diode bridge V6001...V6004 a d.c. voltage is applied to the converter circuit.
This voltage is smoothed by capacitors C6007, C6008 and chokes L6000, L6001 and L6002.
Depending on the mains voltage, the rectified voltage is 120 V...370 V.

NOTE: All measurements in the primary circuit should be done with a floating oscilloscope. As reference voltage can be used measuring point X48.

A fixed part of the mains voltage serves as a LINE-trigger signal.
The amplitude of the LINE trigger signal is 1/22 x MAINS.

NOTE: The LINE trigger signal is not present when a d.c. voltage serves as MAINS.

9.2 CONVERTER CIRCUIT

(see figures 9.1, 9.2 and 9.3)

In this oscilloscope a flyback converter is used to generate the required voltages out of the LINE IN voltage. The combination of the transistors V6014 and V6018 functions as a switch in this flyback converter. The converter switching frequency depends of the amplitude of the LINE IN voltage (for 110 Vac: 30 kHz approx and for 220 Vac: 45 kHz approx).

Transistors V6014 and V6018 conduct on the forward stroke and charge transformer T6001. Thyristor V6013 fires when the voltage on the gate reaches the firing level (0,6 V approx). Consequently V6018 blocks and V6014 blocks (flyback stroke). During this flyback stroke, the secondary windings of T6001 discharge via the diode rectifiers into smoothing capacitors. The NTC resistor R6009 provides temperature compensation for the firing point of the thyristor. During the flyback, capacitor C6009 charges gain via the path T6001-1, V6012, V6009, R6001, C6009, and T6001-2.

At the end of the flyback, when C6009 has been charged, the voltage over this capacitor is stabilized by a voltage stabilizer and is used to switch on again V6014 (and V6018). The voltage stabilizer, consisting of V6009, R6006 and V6012, outputs a square-wave signal to the gate of transistor V6014 with a maximum amplitude of 15 V.

The dv/dt limiter with L6004, L6006, V6017 and V6019 serves to slow down the increase of the collector voltage of V6018 when this transistor is switched off (see figure 9.1)

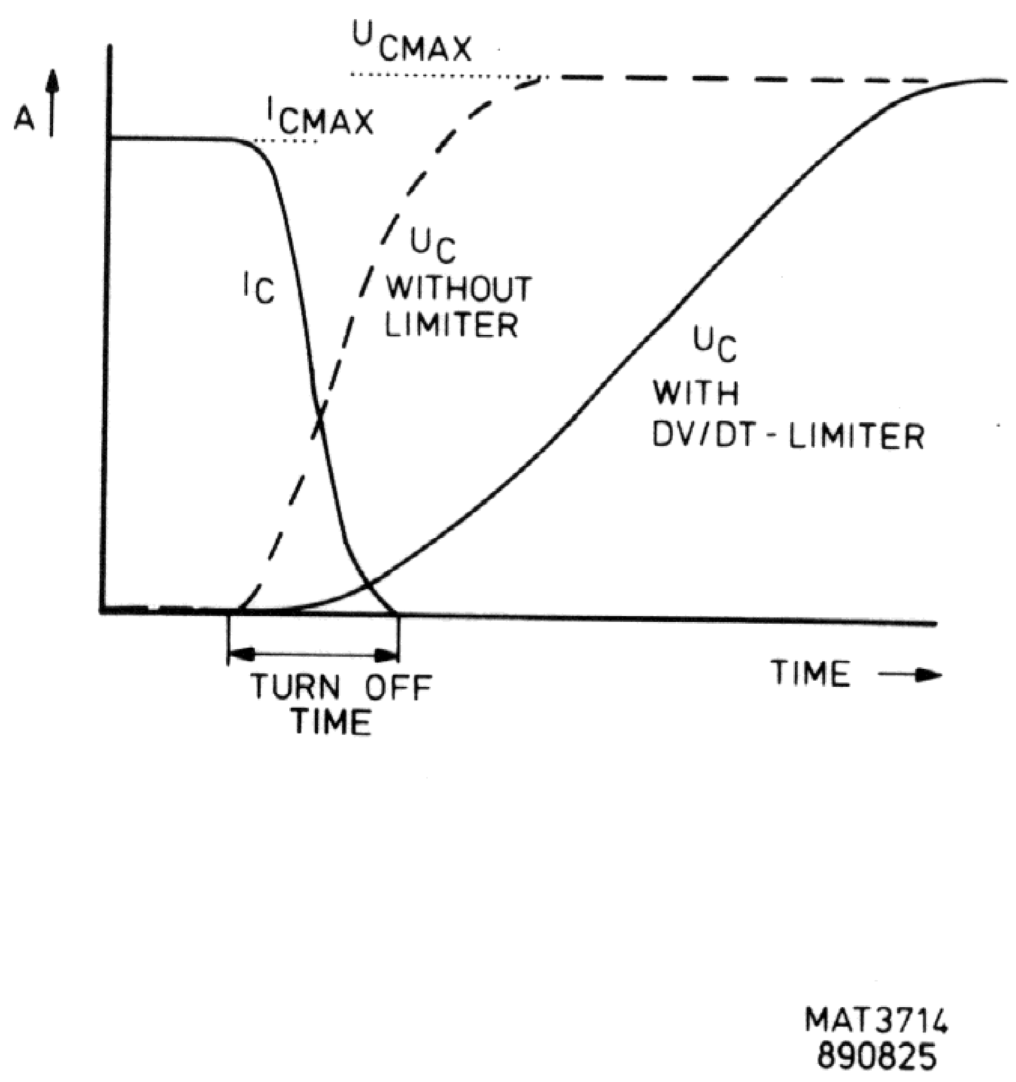


Figure 9.1 Collector-voltage and -current waveforms of V6018 (switching off).

By slowing down the increase of Uc (i.e. limiting dv/dt), the product P = Uc Ic of the collector voltage Uc and the collector currrent Ic, build up in the transistor while switching off, is limited.

The voltage control circuit (N6001(5-6-7) and associated components) feed back any variation in the -12 R voltage to the gate of V6013. For example: if the -12 V voltage is too low, more current is sent into H6001. Because of the extra current, V6013 fires earlier so that the output voltage decreases.

NOTE: *The only function of diode V6021 is protection of R6017, R6018 and the circuit that controls the base of V6018. If the main fuse has blown, always check V6021, too !*

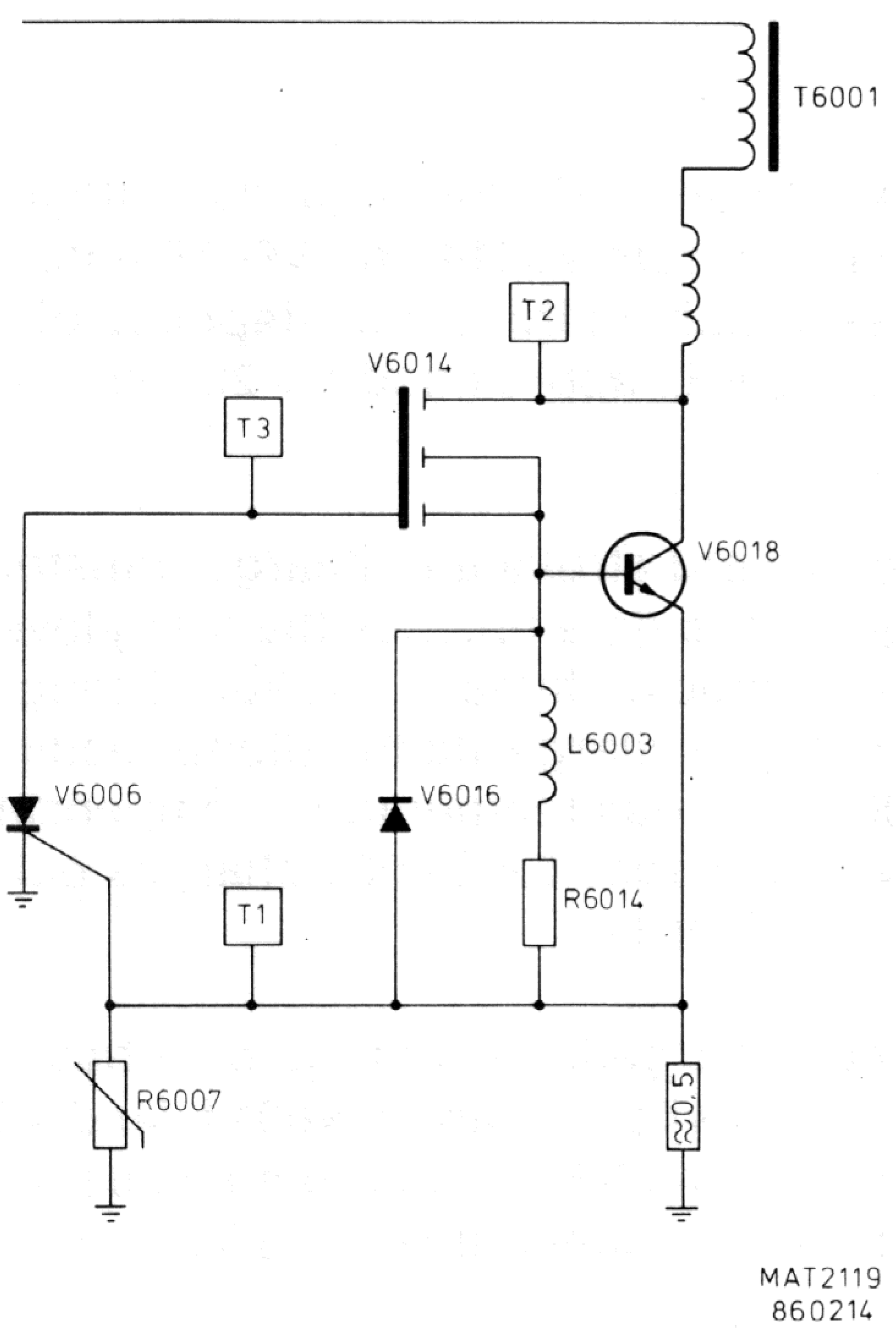


Figure 9.2 Converter circuit

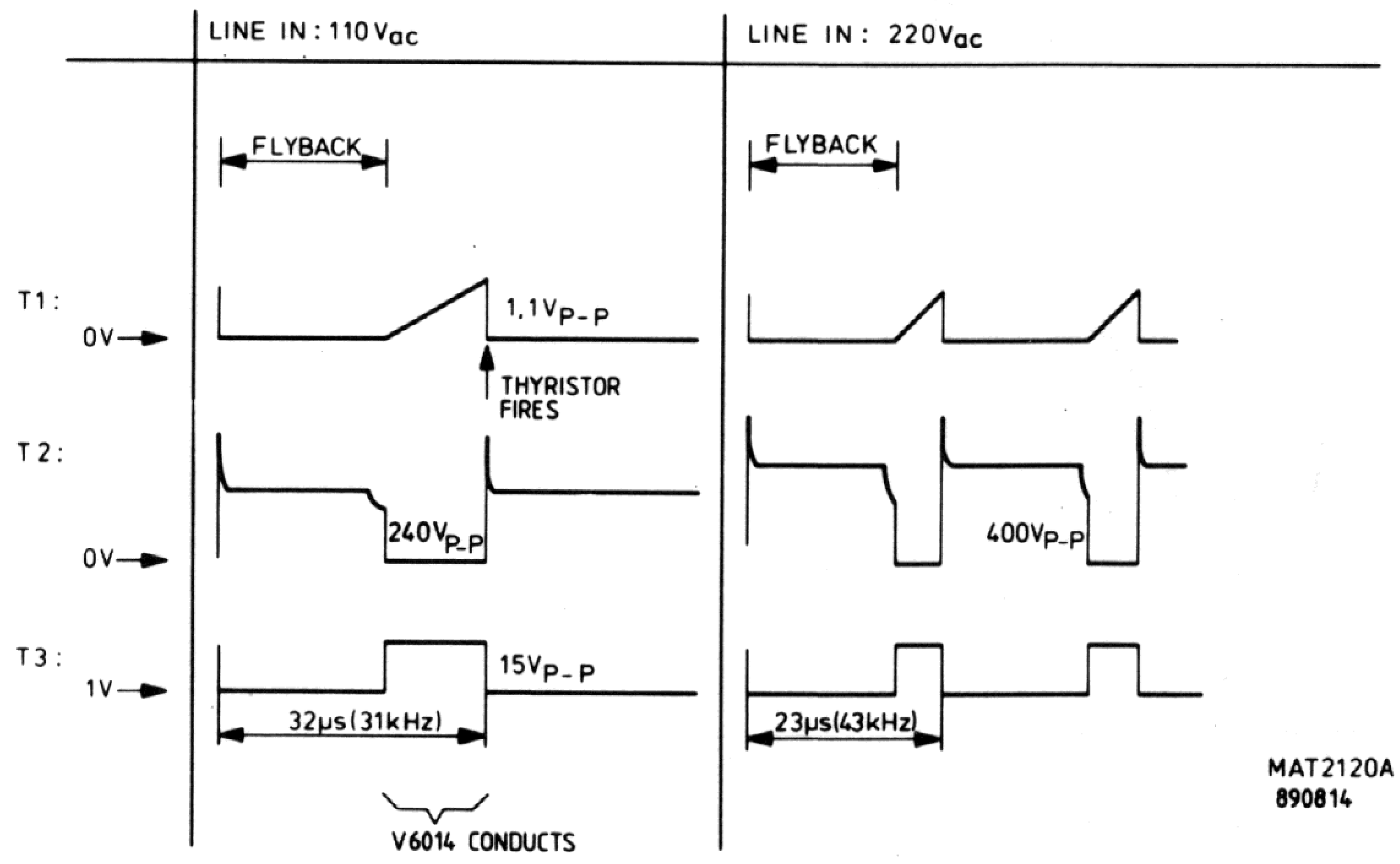


Figure 9.3 Timing diagram converter circuit

9.3 SECONDARY OUTPUT RECTIFIERS

The output voltages taken from the secondary windings of transformer T6001 are rectified by diodes and smoothed by capacitors in conventional circuits.
A "CROWBAR" circuit with transistor V6137 and V6112 protects the +5 V supply. When the +5 V level is too high, transistor V6137 (and V6112) conduct and the power supply goes into short circuit mode. (This results in a decrease of the converter switching frequency).

A voltage protection circuit using V6134, V6136 and V6112 protects against overload. When the power supply is overloaded, these components conduct and the power supply goes into in the short-circuit mode.

9.4 HT SUPPLY

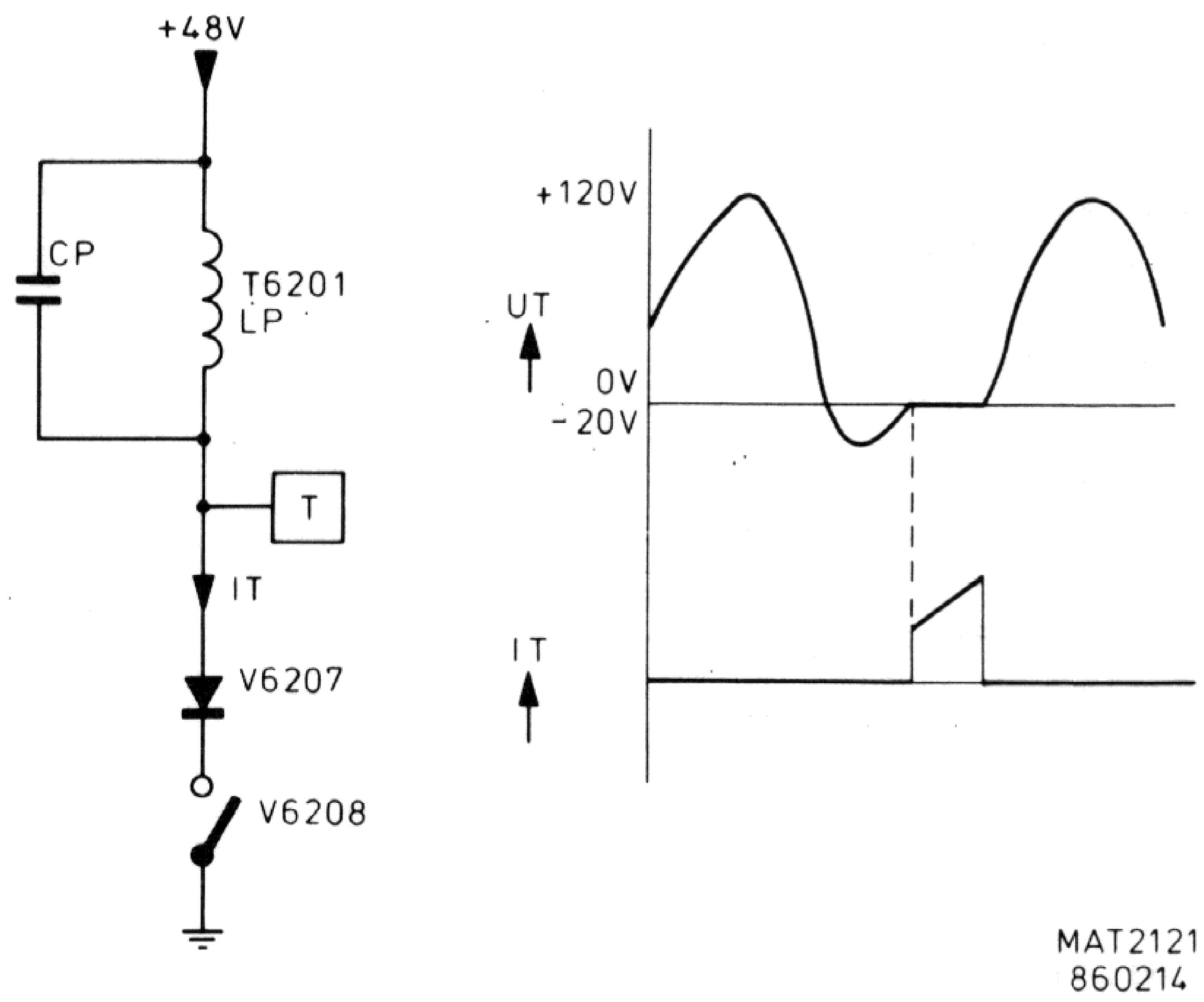


Figure 9.4 HT oscillator

The HT supply consists of an oscillator and a regulator circuit.
Transformer T6201 determines the frequency (50 kHz approx.) of the oscillator. The output signal voltage on the secondary winding of T6201 is rectified by diode V6209 and smoothed by C6211. The -2,1 kV is also converted to -14,5 kV in the HT multiplier D6201 and routed via connector X6030 to the post-acceleration anode of the CRT.

To regulate this HT voltage the -2 kV is fed to the input of OP-AMP N6002.
The output level of N6002 determines the energy to T6201, and thus the amplitude of the HT-voltage.

9.5 CALIBRATOR

The calibrator circuit consists of two analog switches D6501(8-9) and D6501(11-10) controlled by the active HIGH enable inputs 6 and 12 respectively, that are connected as an 2 kHz astable oscillator. Capacitor C6502 and resistor R6504 determine the 2 kHz frequency. The oscillator outputs, applied to enable inputs 5 and 13 of the second stage are in anti-phase with each other. Depending on the level of input 5 and 13, the CAL voltage will have a 1,2 V level or a 0 V level.

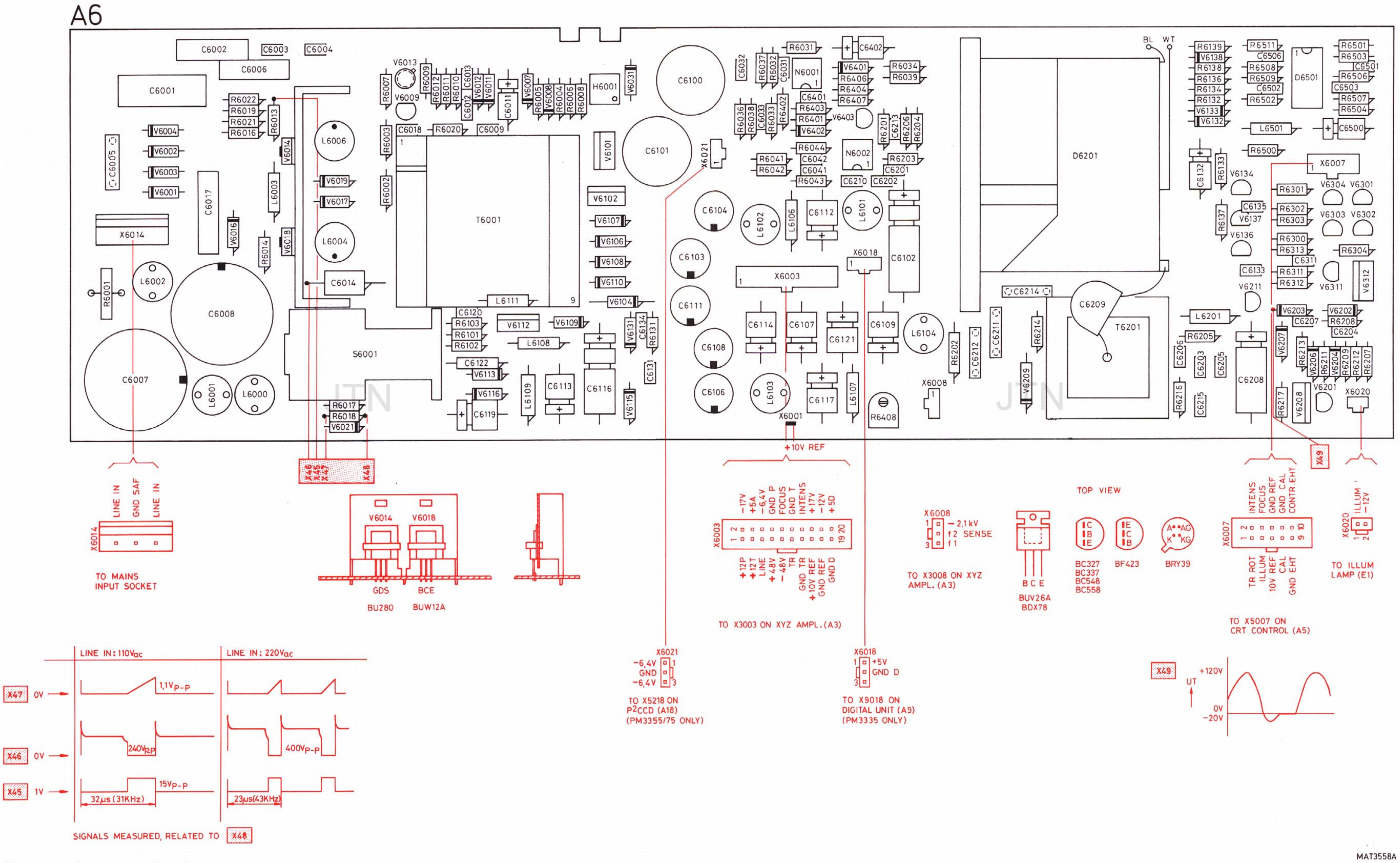
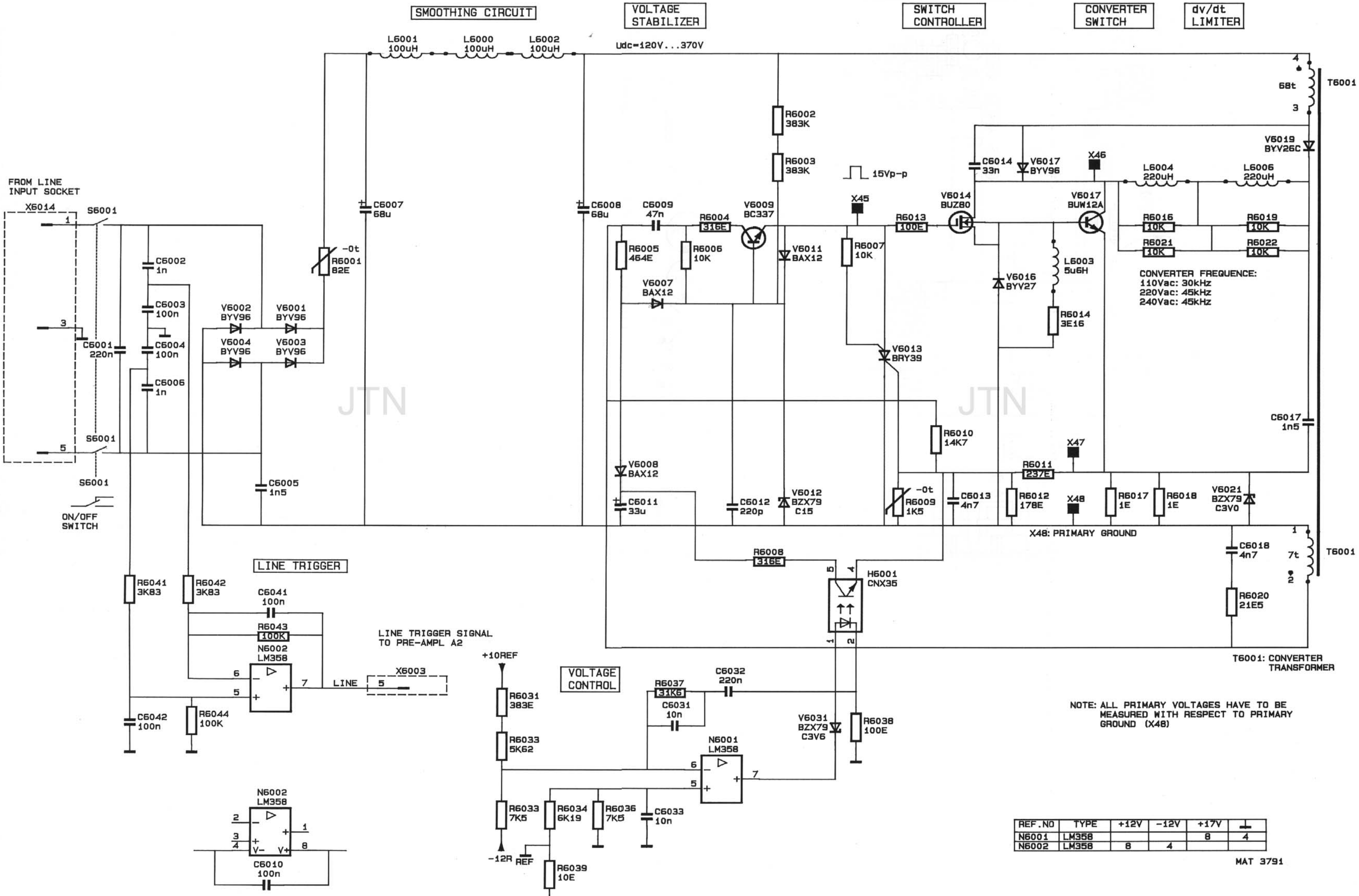


Figure 9.5 Power supply unit p.c.b.



REF.NO	TYPE	+12V	−12V	+17V	⏚
N6001	LM358			8	4
N6002	LM358	8	4		

Figure 9.6 Circuit diagram of power supply, primary circuit

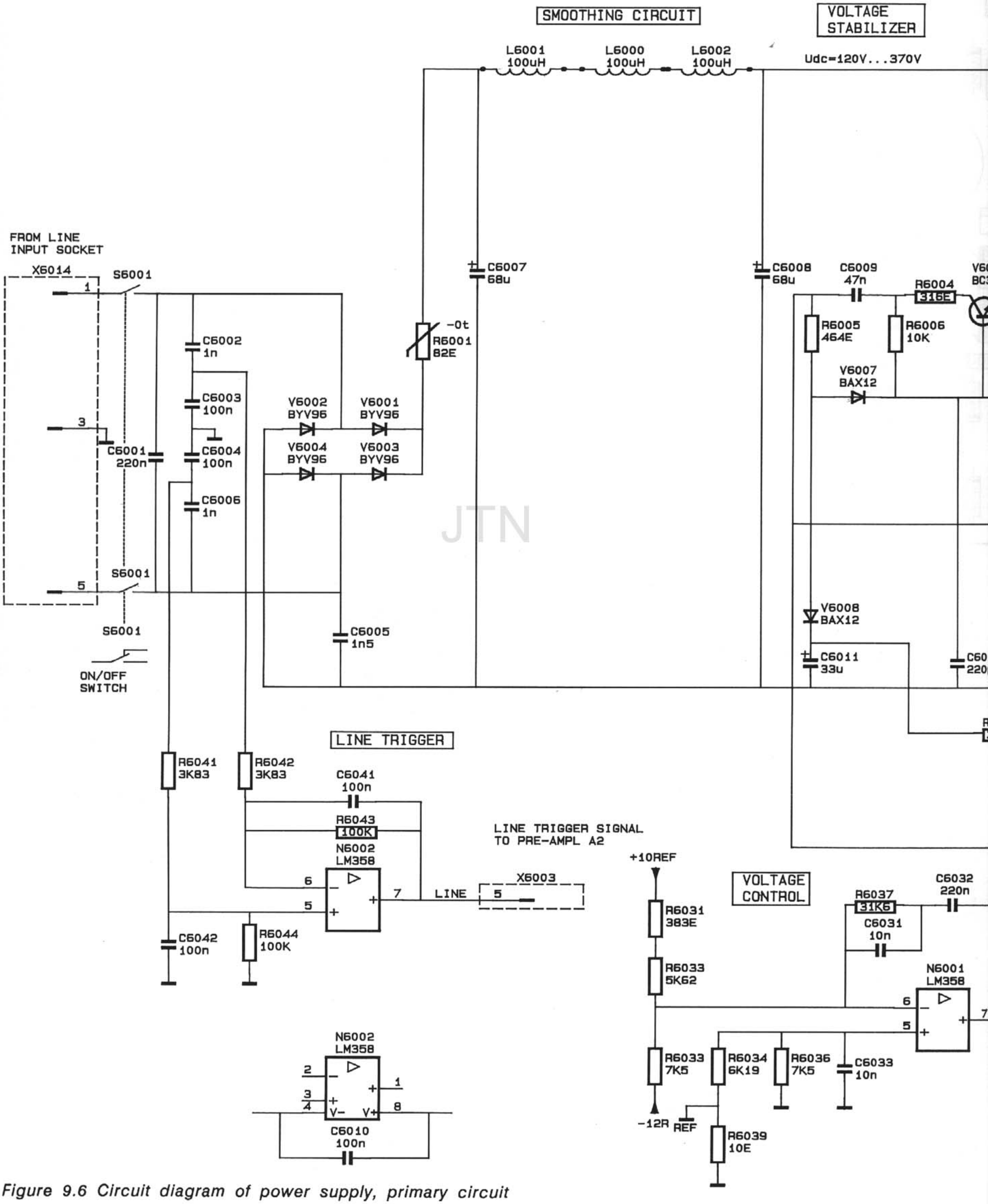
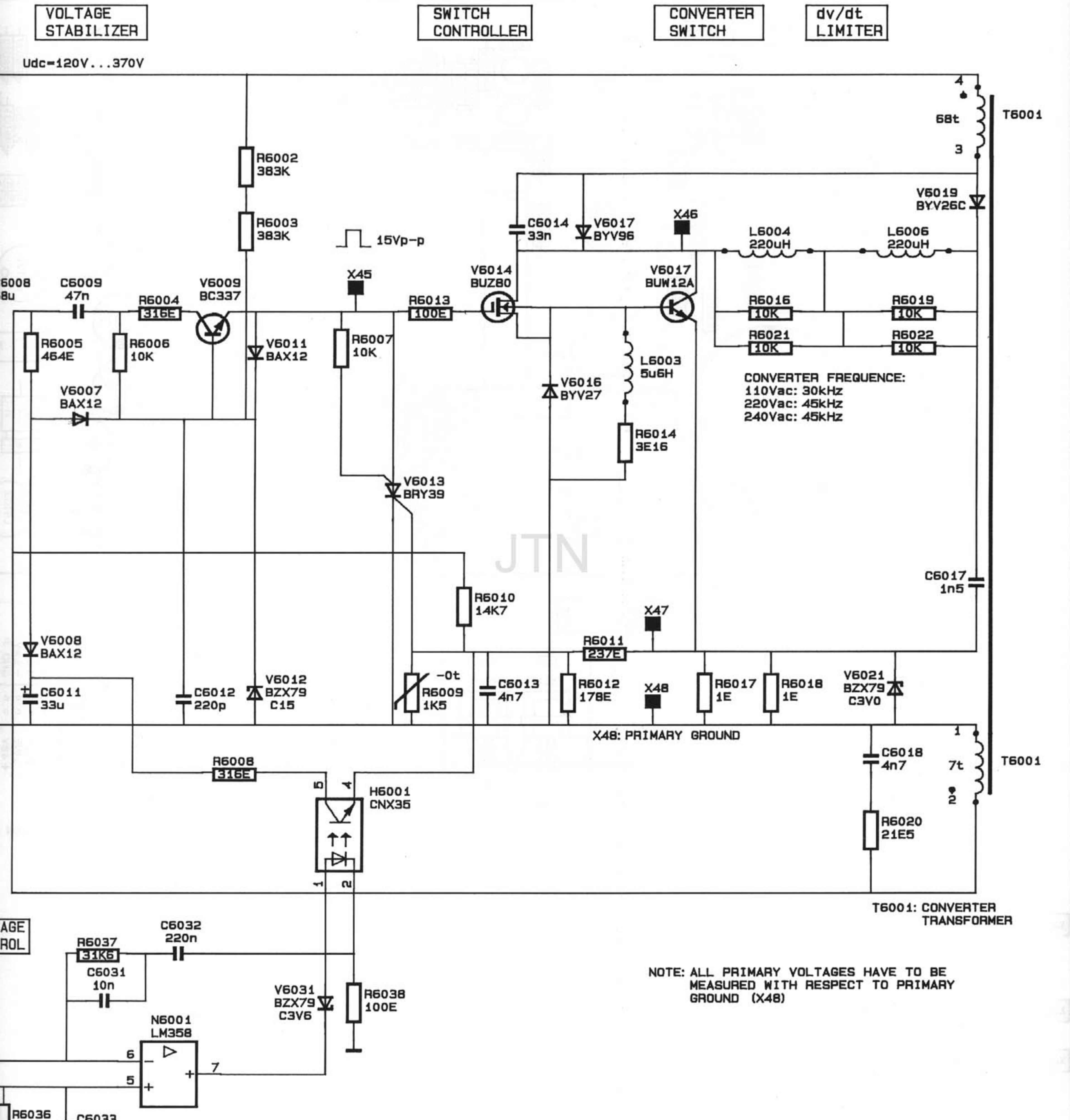


Figure 9.6 Circuit diagram of power supply, primary circuit



REF.NO	TYPE	+12V	-12V	+17V	⏊
N6001	LM358			8	4
N6002	LM358	8	4		

MAT 3791

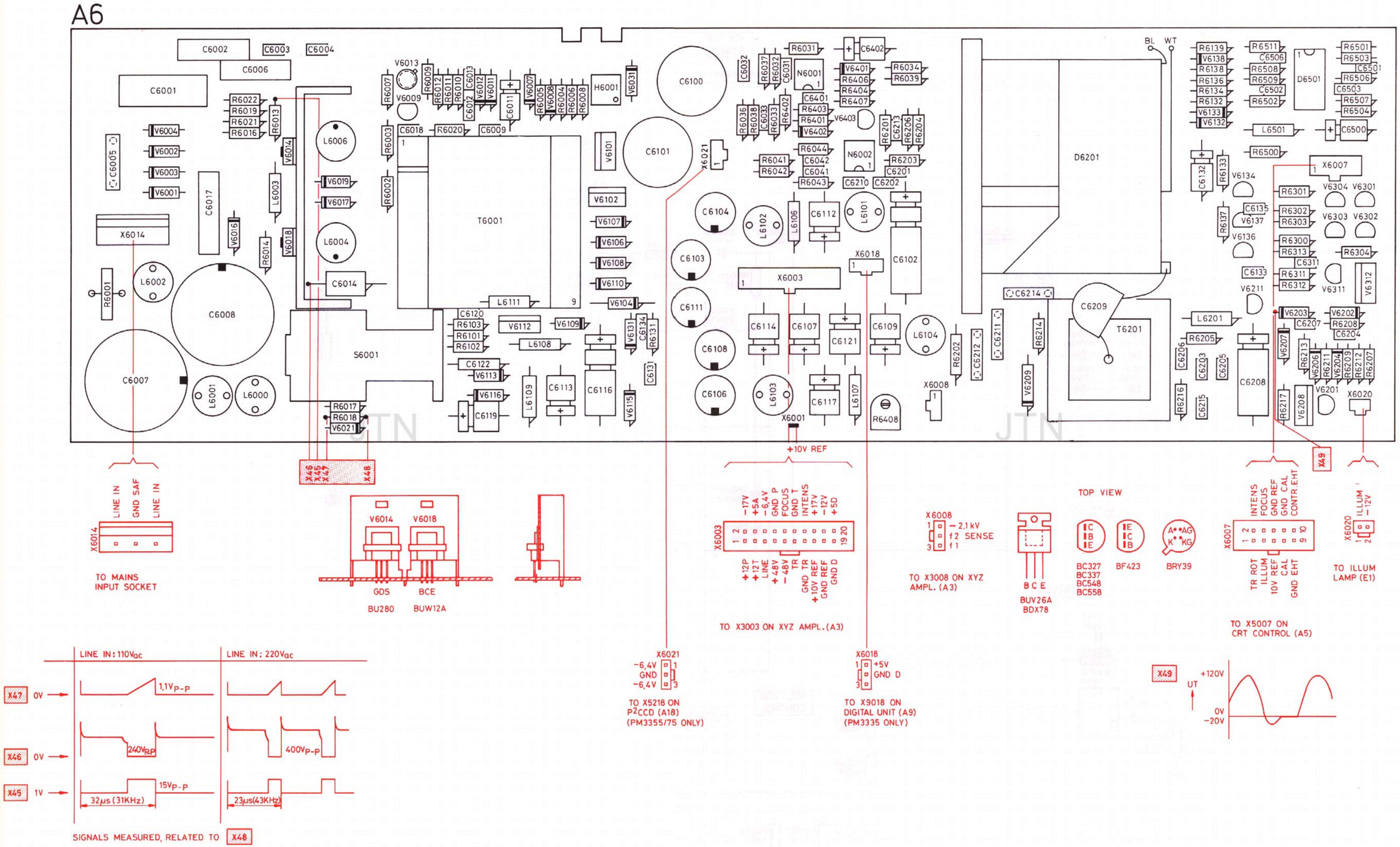
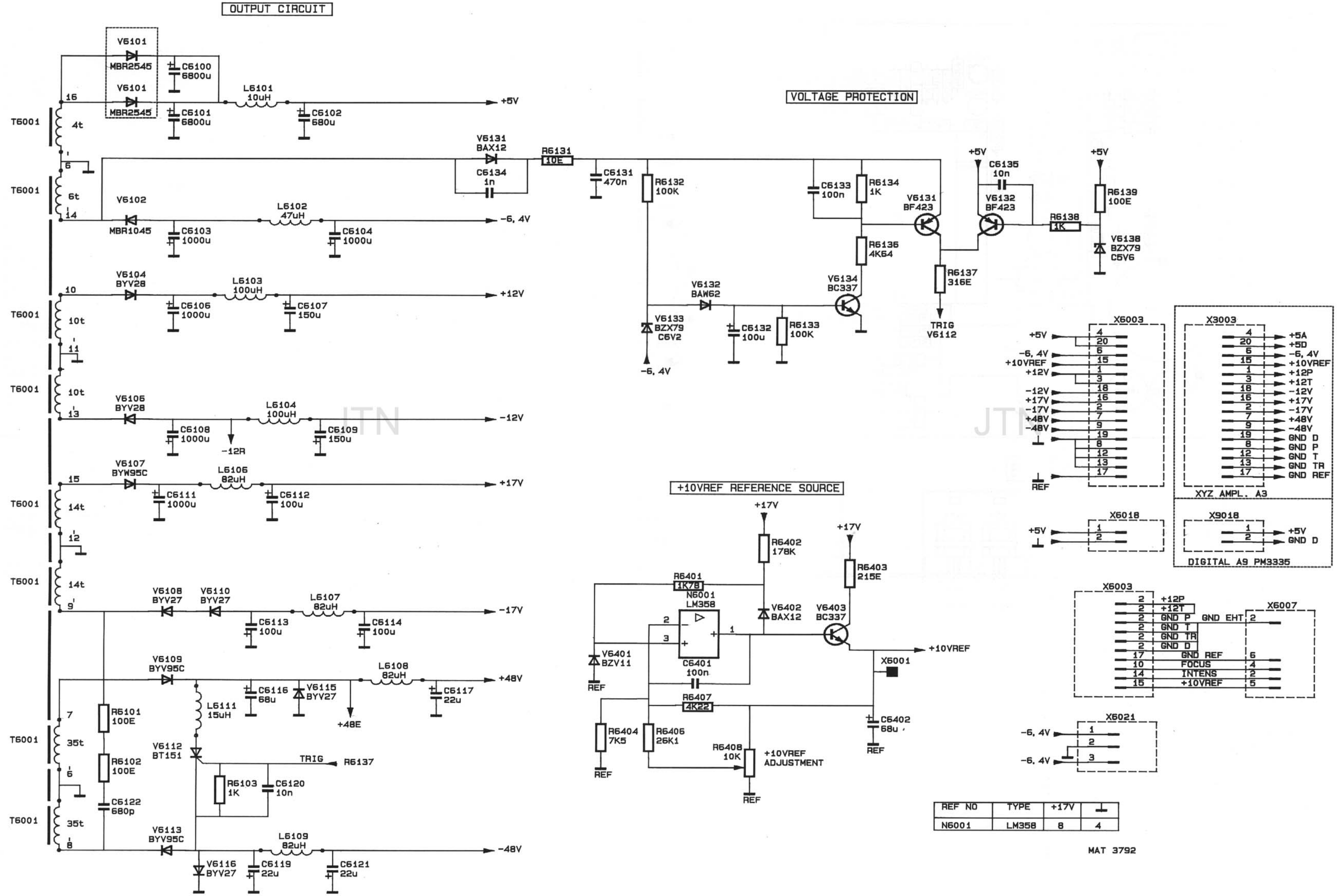


Figure 9.7 Power supply unit p.c.b.

MAT3558A



REF NO	TYPE	+17V	⊥
N6001	LM358	8	4

Figure 9.8 Circuit diagram of power supply, secondary circuit

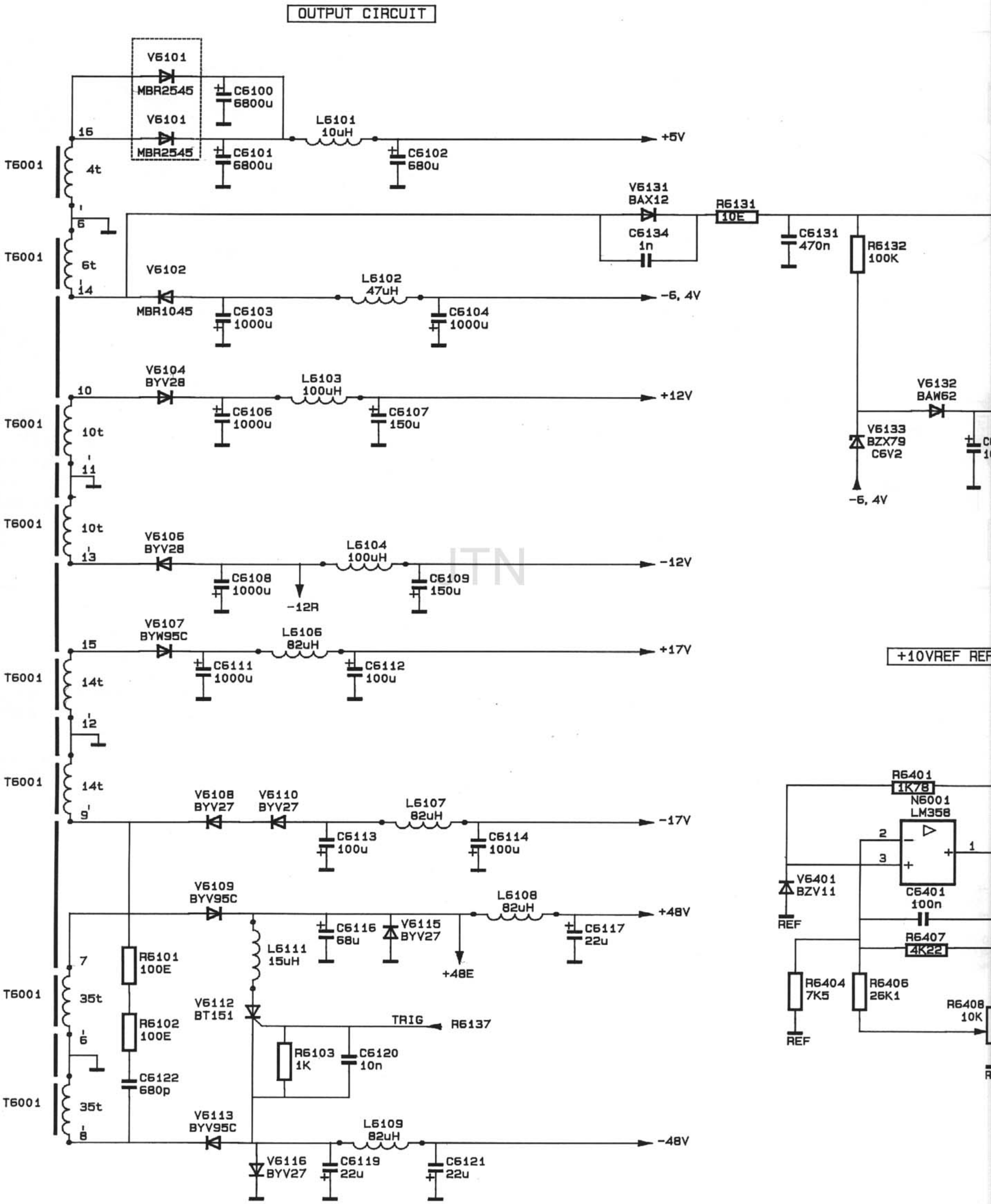
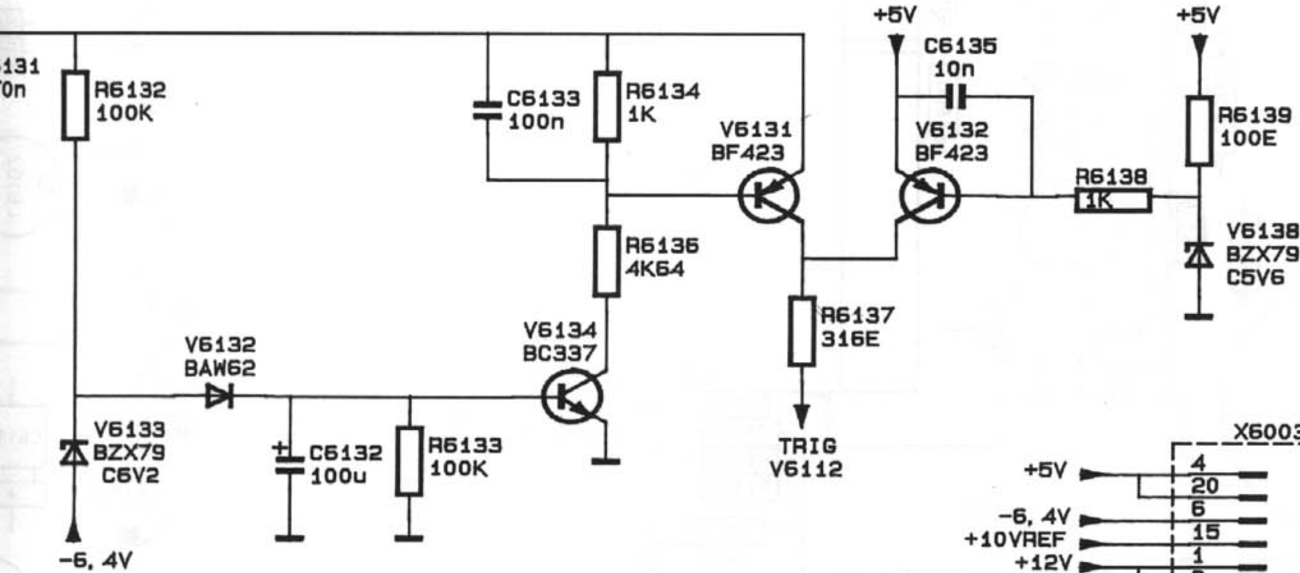
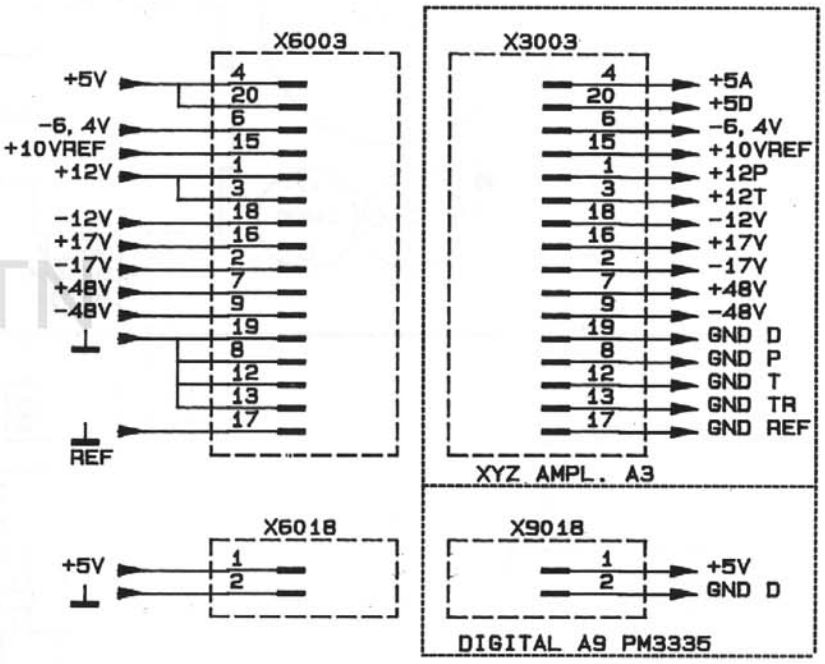


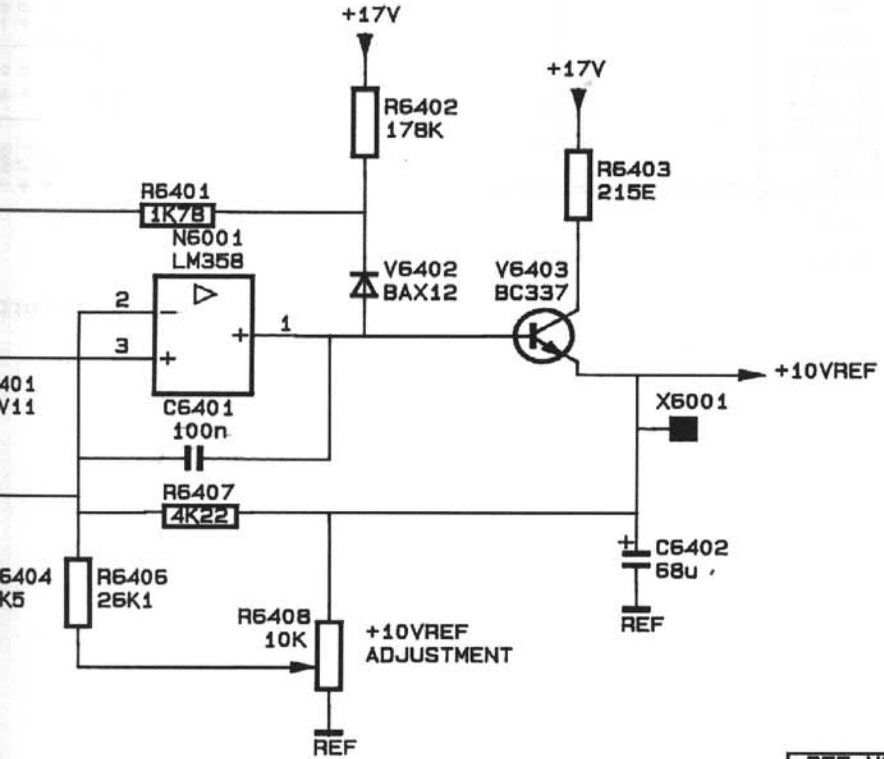
Figure 9.8 Circuit diagram of power supply, secondary circuit

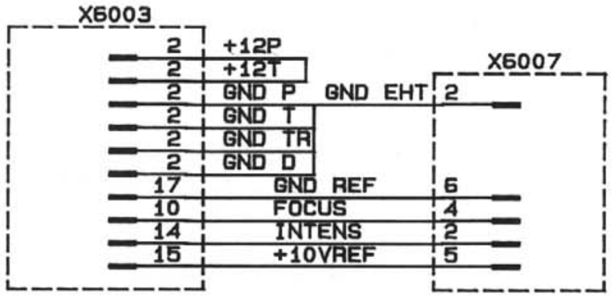
VOLTAGE PROTECTION

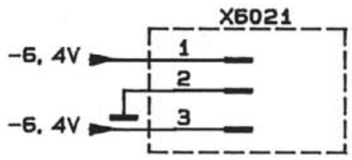




+10VREF REFERENCE SOURCE







REF NO	TYPE	+17V	⊥
N6001	LM358	8	4

MAT 3792

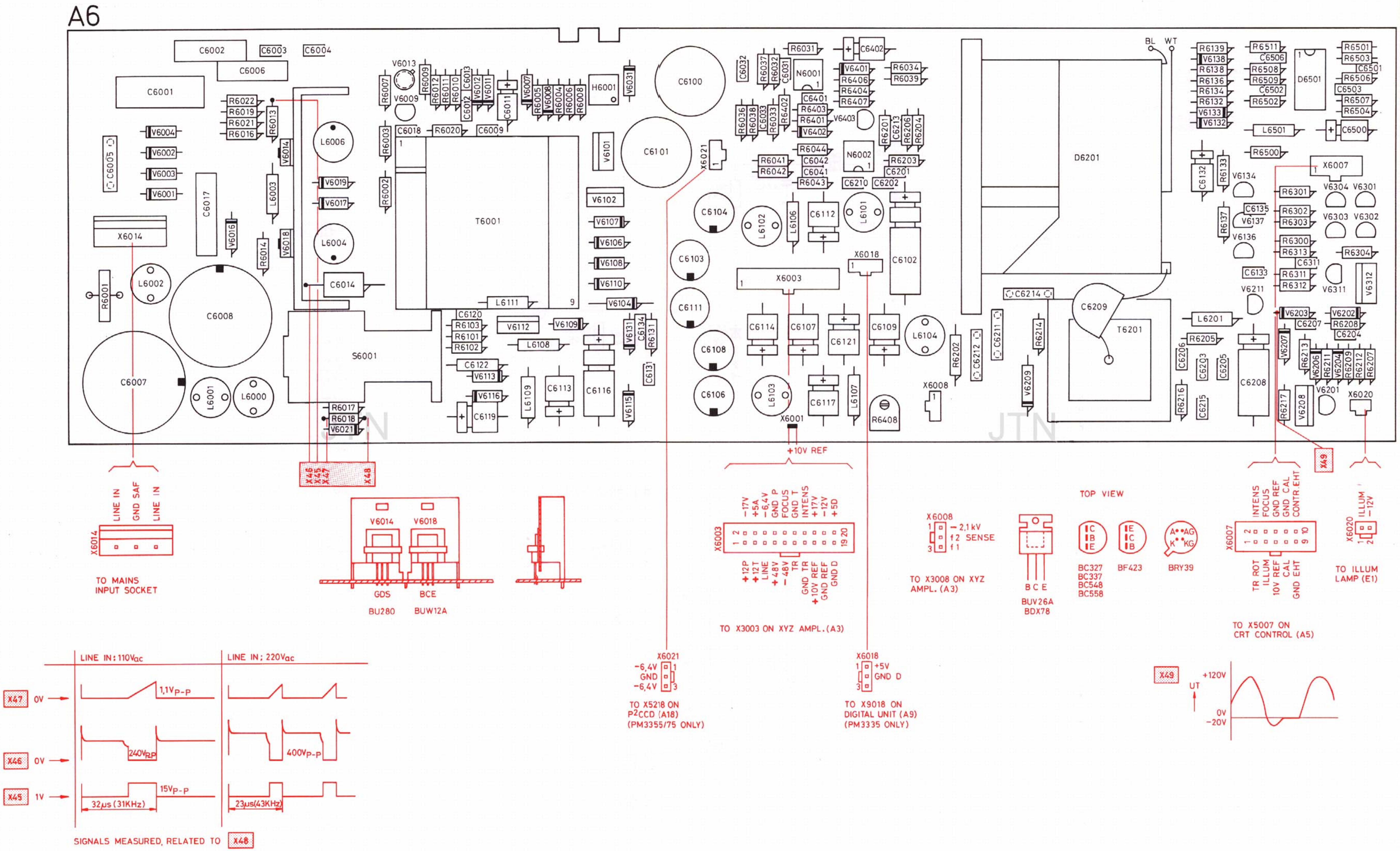


Figure 9.9 Power supply unit p.c.b.

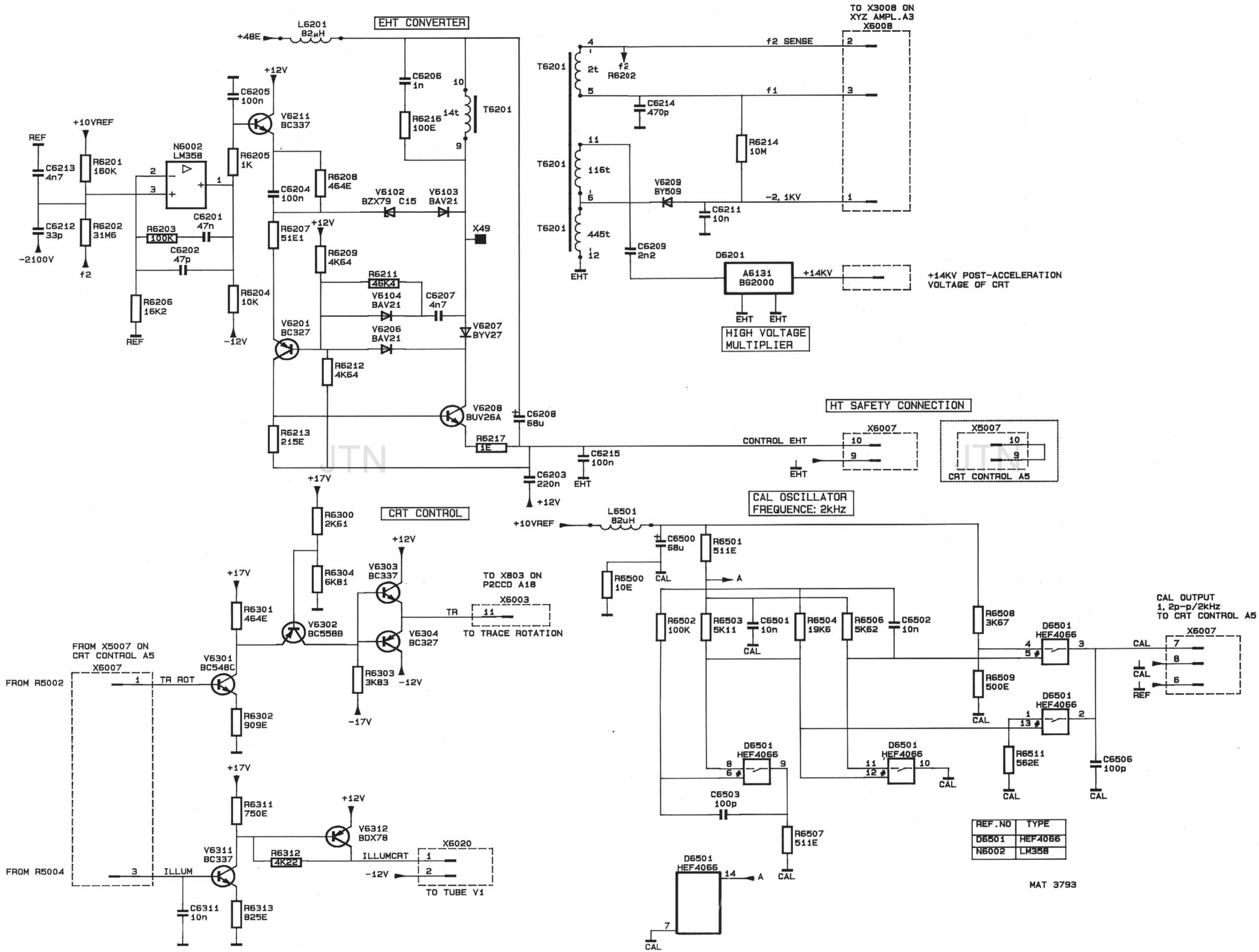


Figure 9.10 Circuit diagram of power supply, EHT circuit and various

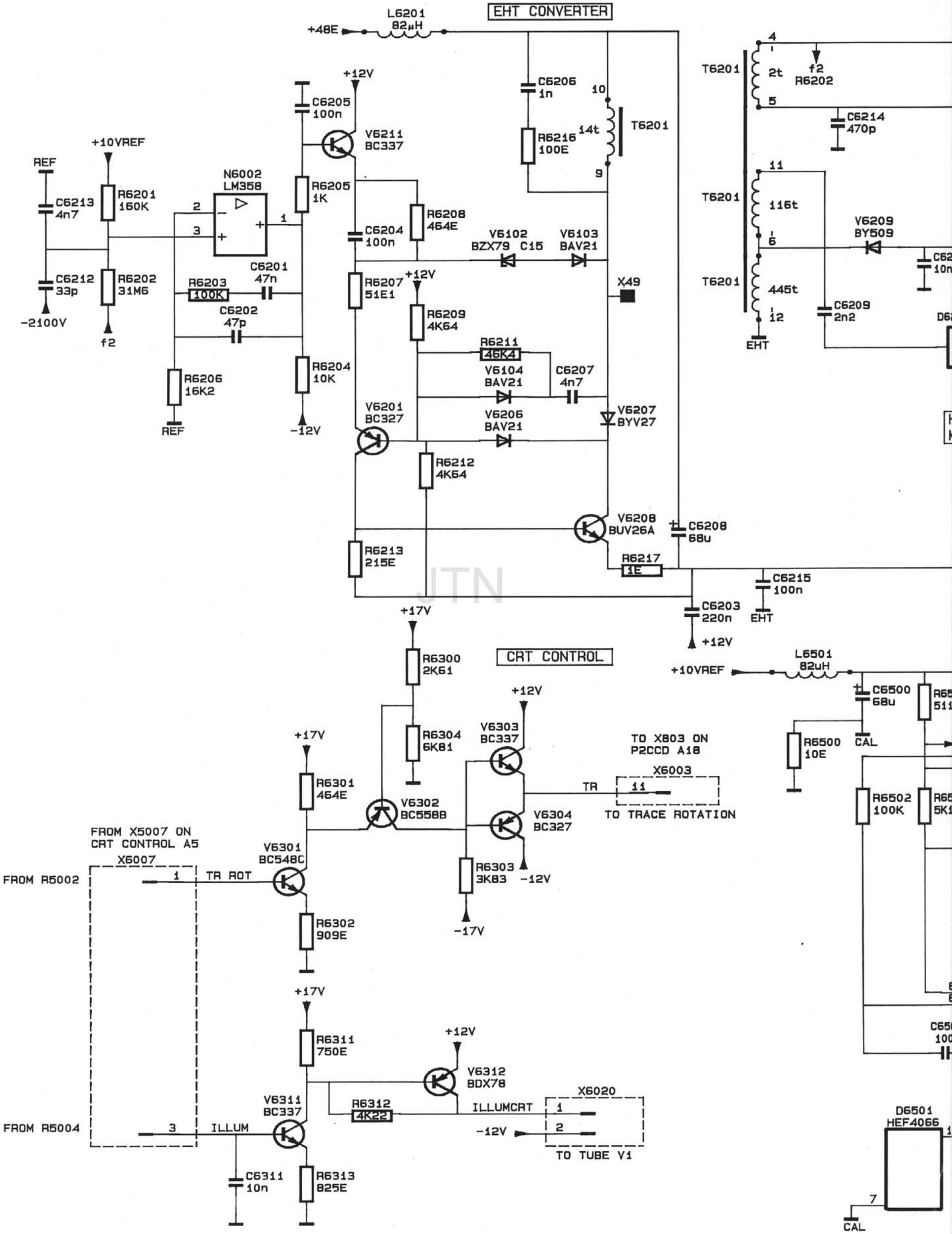
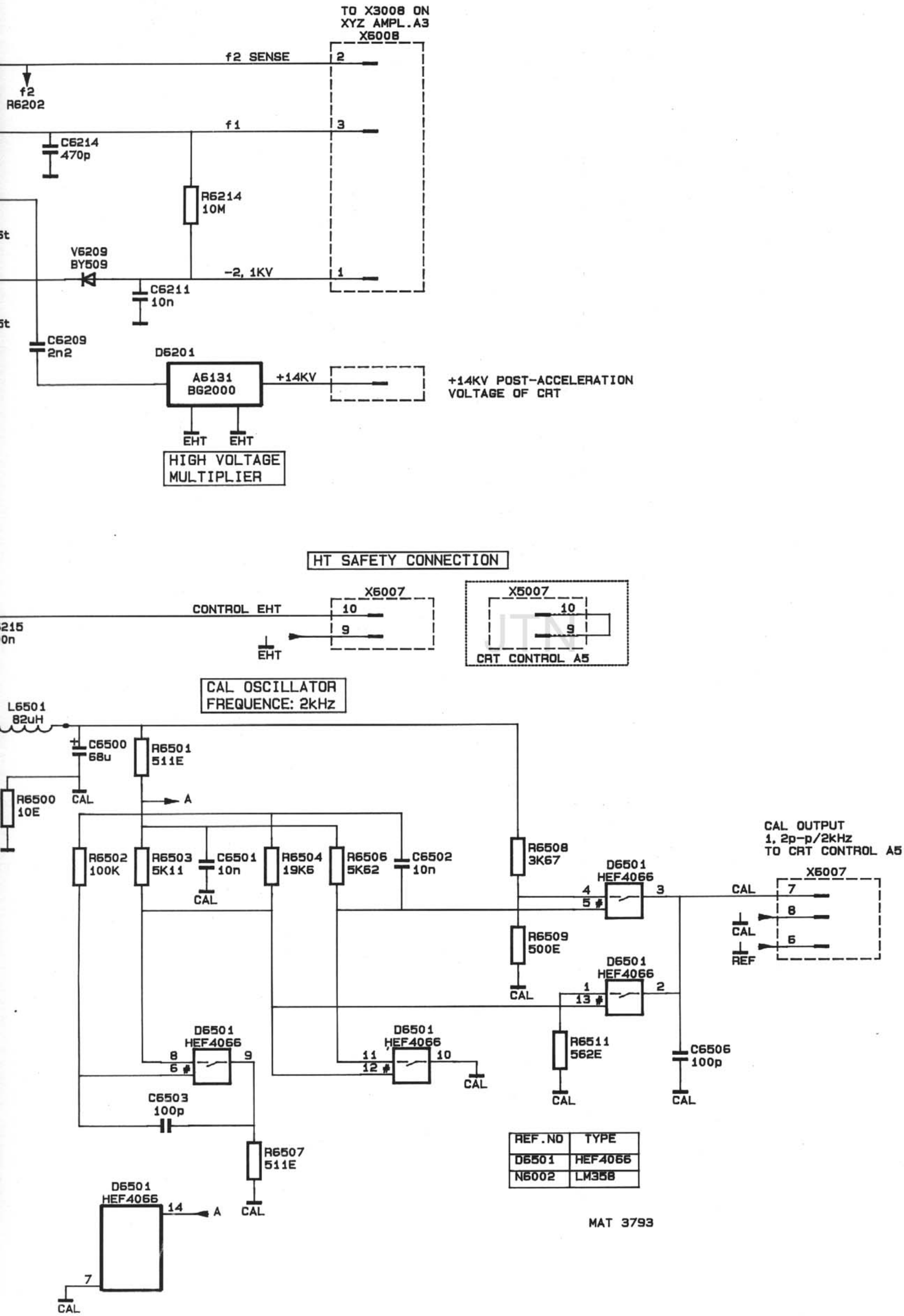


Figure 9.10 Circuit diagram of power supply, EHT circuit and various



REF.NO	TYPE
D6501	HEF4066
N6002	LM358

MAT 3793

10 FRONT UNIT (A7-A8)

The front unit consists of:

- the key-matrix
- the front controls and indicator
- the LCD display

10.1 KEY-MATRIX

The key matrix is connected to two remote 8 bit I/O ports. ROW 1...8 is applied to D7001 and COLUMN 1...8 is applied to D7002. Depending on the softkey which is depressed, a certain ROW and COLUMN will be influenced. This is read by the SDA0 line and thus by the microprocessor. The lines ROW 1, COL 1, COL 3, COL 5, COL 6 and COL 7 are also connected to the cursor unit A9 and read the cursor softkeys.

10.2 FRONT CONTROLS AND INDICATOR

The front-panel controls give a voltage between 0...10 V to the various circuits. To determine the UNCAL position of VAR A, VAR B or VAR, the dc voltages on the slider of the potentiometer are applied to comparator N7001. When the voltage level of the control is lower than 0,7 V, the I^2C bus reads a logic high. Then the microprocessor adapts the LCD display to indicate the CAL status (e.g. no flashing " > " segment visible)

Integrated circuit D7004 (OQ0044) detects the kind of probe which is connected to the oscilloscope. Depending on the resistance between the probe indication input (pin 3 for channel A and pin 16 for channel B) and ground, the V/DIV reading of the LCD automatically increases according to the following table:

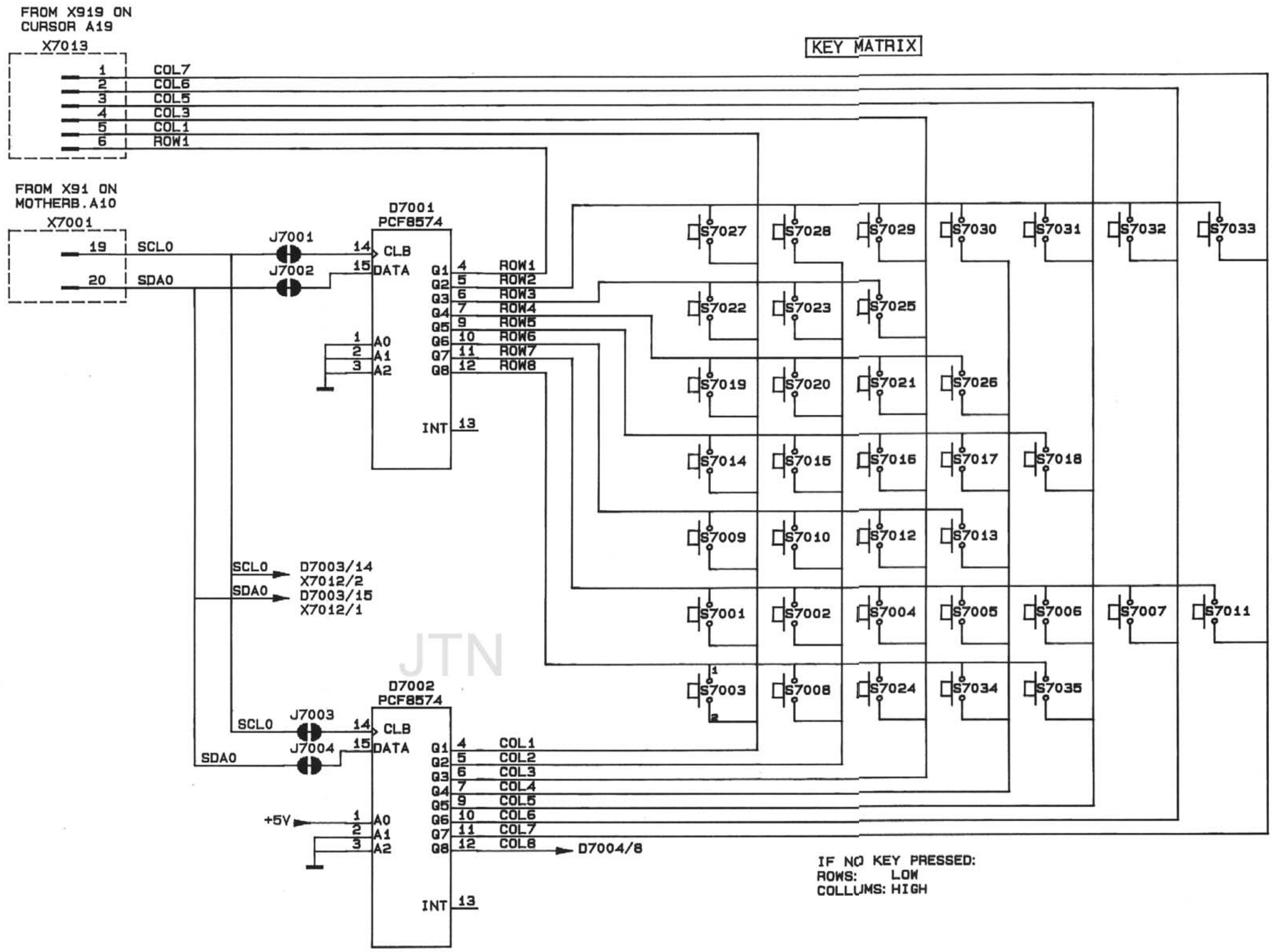
Pin 3 (16)	Pin 6 (17)	Pin 7 (12)	V/DIV attenuation
2k32	0	0	x10
6k98	1	0	x100
7k68	0	1	x1
10k	1	1	x1

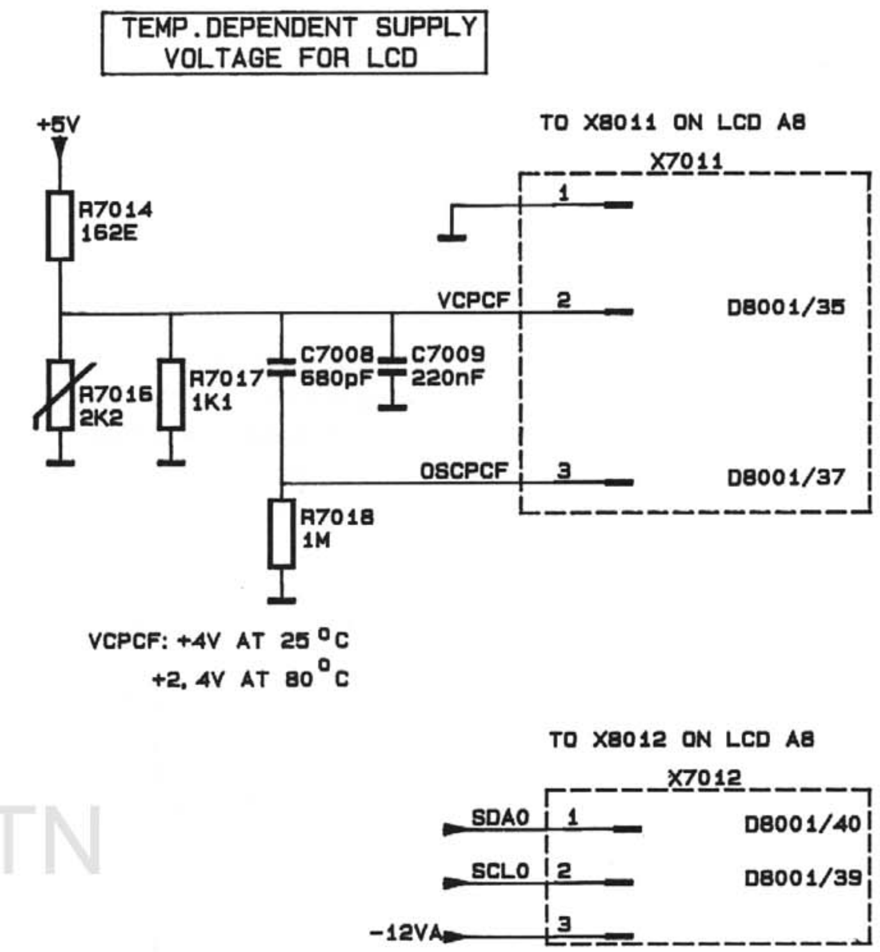
10.3 LCD DISPLAY CIRCUIT

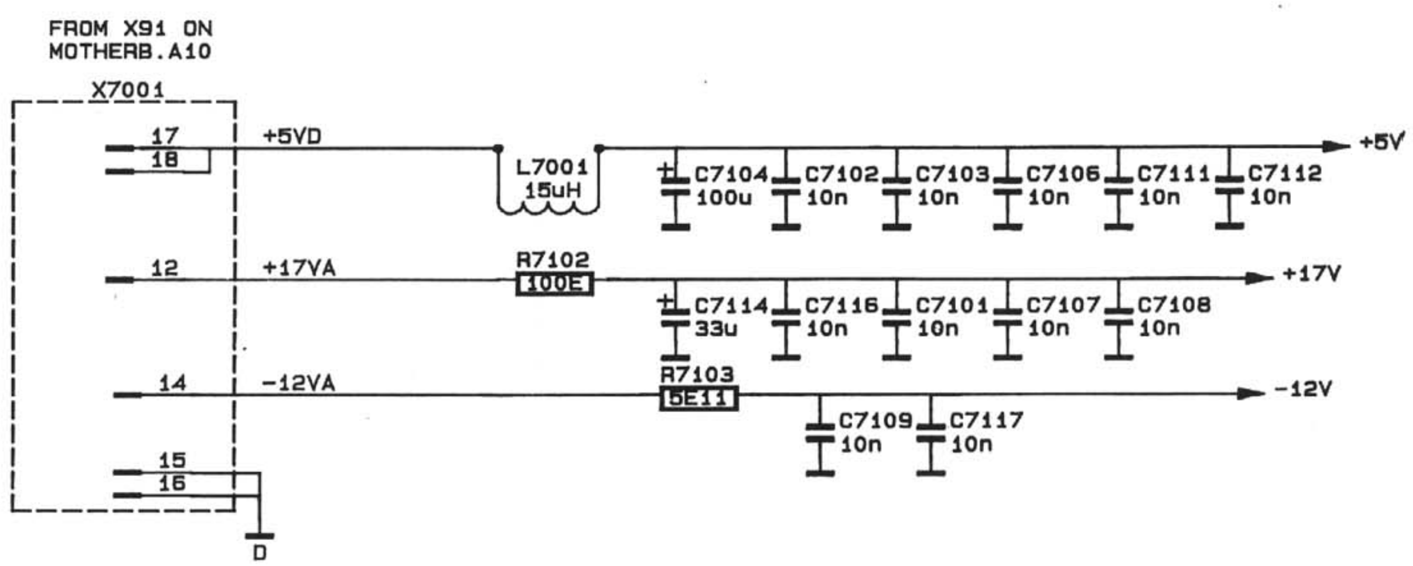
The LCD is driven by three drivers D8001, D8002 and D8003 (PCF8577).
The temperature dependent supply voltage VCPCF is 4 V approx. at 25° C. When the temperature increases, this voltage also decreases.
The single-pin built-in oscillator on pin 37 of D8001 provides the modulation frequency for the LCD segment driver outputs. Capacitor C7008 and resistor R7018 are connected to this pin to form the oscillator, with a frequency of 150 Hz approx. Pin 36 and pin 37 are used to determine the LCD driver address in the I^2C bus.

The outputs pin 1...pin 32 directly drive the LCD.

Outputs BP1 and BP2 (pin 33 and pin 34) drive the COMMON pins of the LCD.



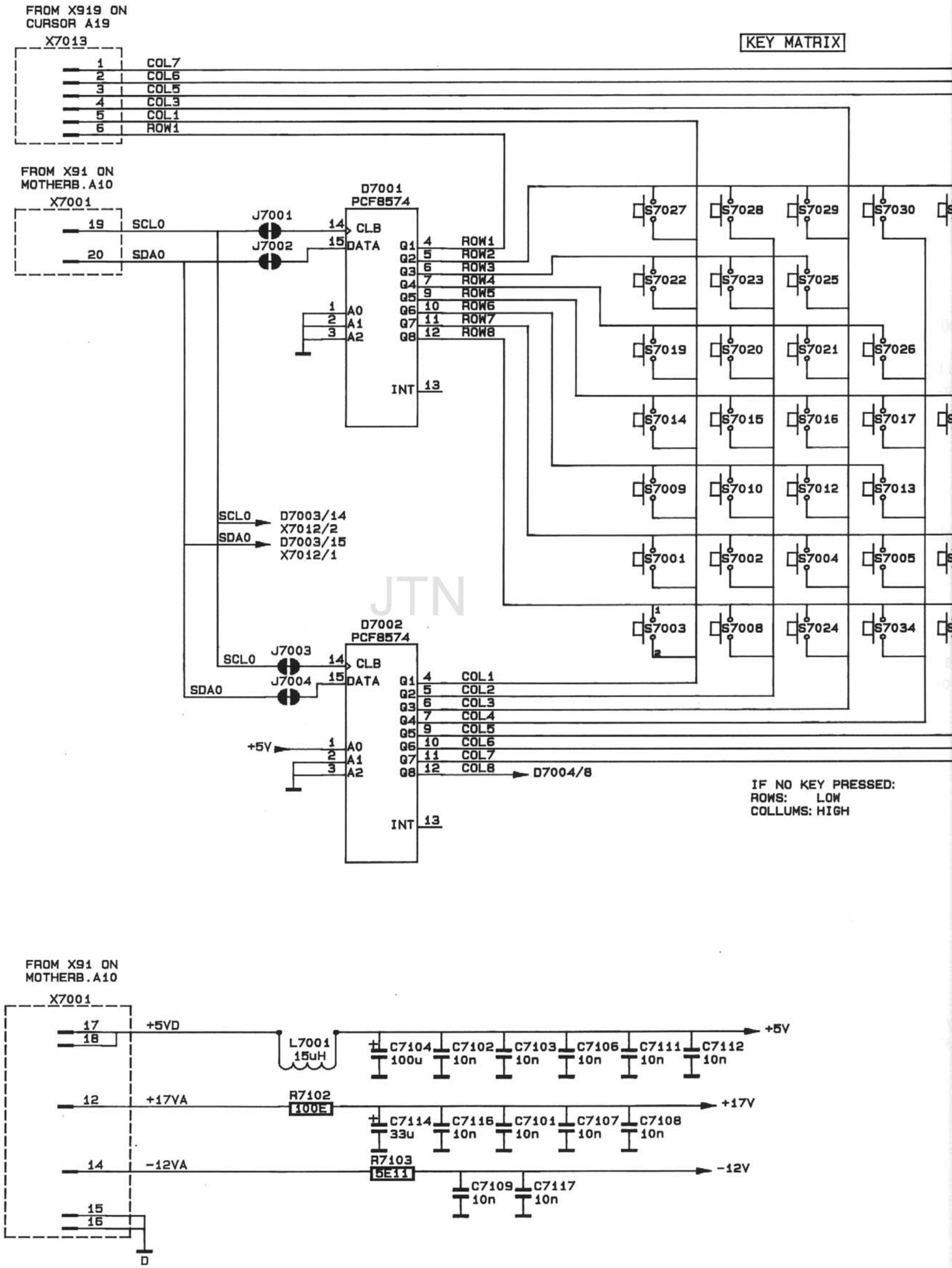




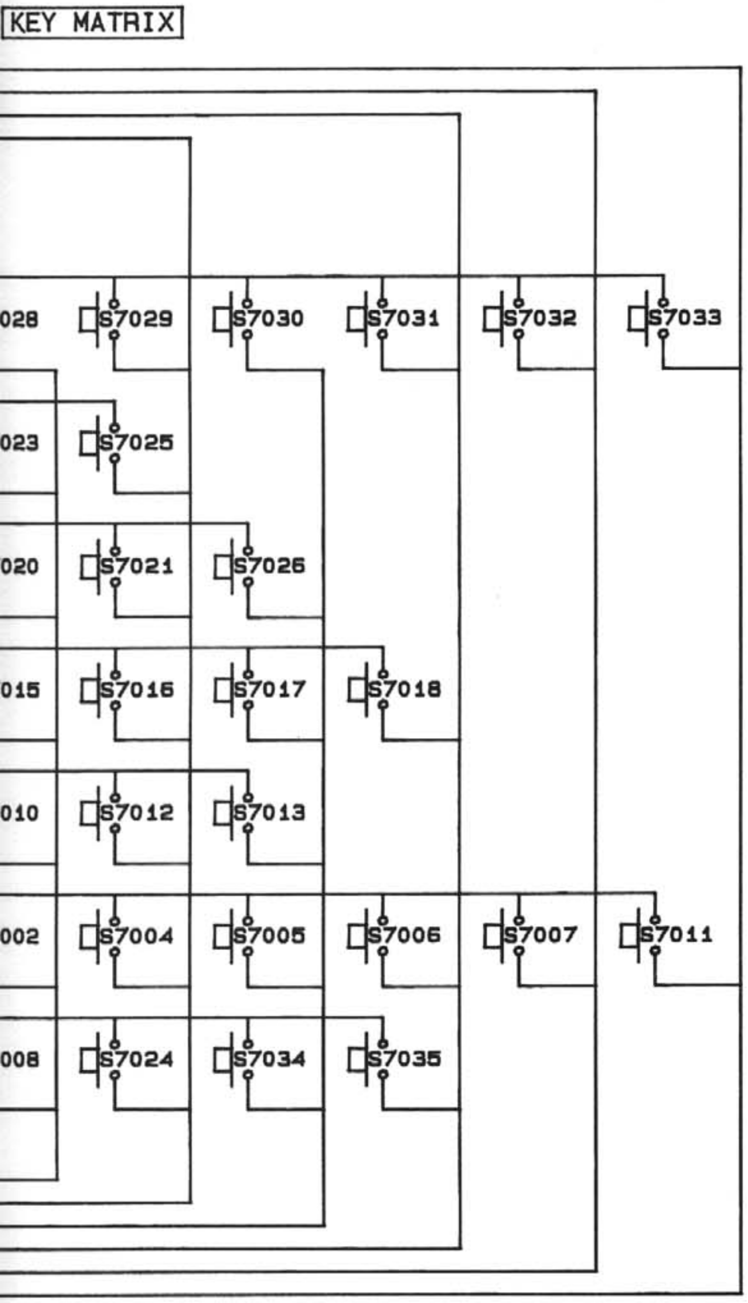
REF NO	TYPE	+5V	⊥
D7001	PCF8574	16	8
D7002	PCF8574	16	8

MAT 35598

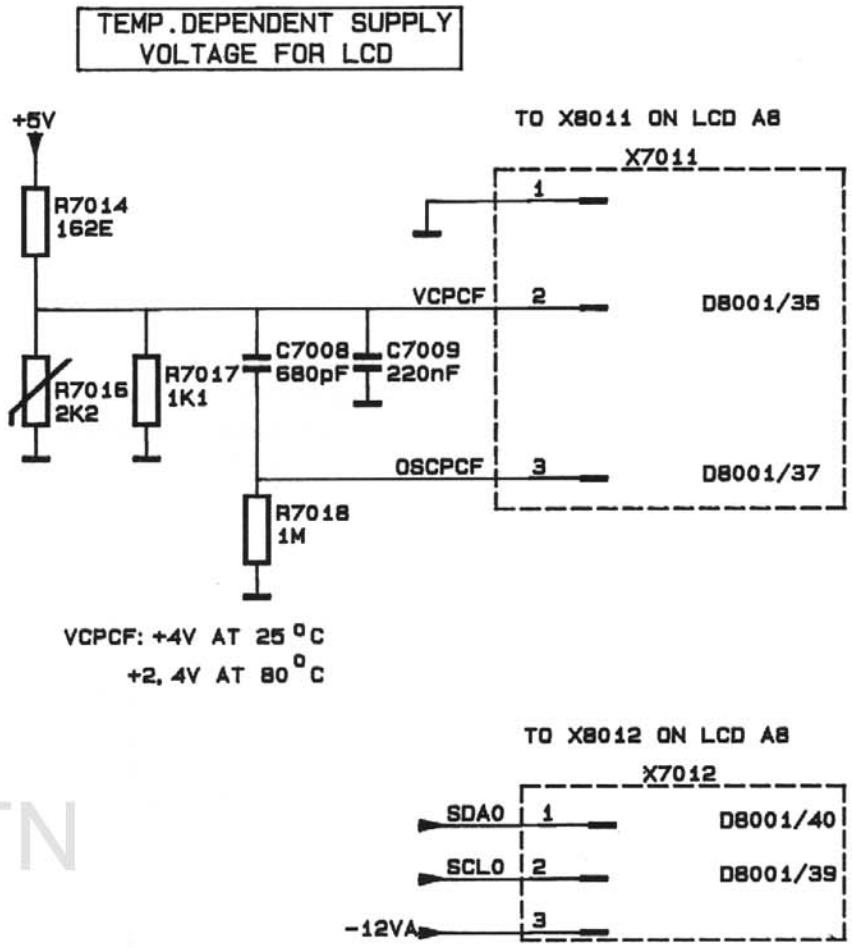
Figure 10.1 Circuit diagram of front unit: key matrix



KEY MATRIX
FROM X919 ON
CURSOR A19
X7013
COL7
COL6
COL5
COL3
COL1
ROW1
FROM X91 ON
MOTHERB.A10
X7001
SCL0
SDA0
J7001
J7002
D7001
PCF8574
CLB
DATA
ROW1
ROW2
ROW3
ROW4
ROW5
ROW6
ROW7
ROW8
INT
S7027
S7028
S7029
S7030
S7022
S7023
S7025
S7019
S7020
S7021
S7026
S7014
S7015
S7016
S7017
S7009
S7010
S7012
S7013
S7001
S7002
S7004
S7005
S7003
S7008
S7024
S7034
SCL0 D7003/14
X7012/2
SDA0 D7003/15
X7012/1
JTN
D7002
PCF8574
J7003
J7004
COL1
COL2
COL3
COL4
COL5
COL6
COL7
COL8
D7004/8
+5V
IF NO KEY PRESSED:
ROWS: LOW
COLLUMS: HIGH
FROM X91 ON
MOTHERB.A10
X7001
+5VD
L7001
15uH
C7104 100u
C7102 10n
C7103 10n
C7106 10n
C7111 10n
C7112 10n
+5V
+17VA
R7102
100E
+17V
C7114 33u
C7116 10n
C7101 10n
C7107 10n
C7108 10n
-12VA
R7103
5E11
-12V
C7109 10n
C7117 10n
D



IF NO KEY PRESSED:
ROWS: LOW
COLLUMS: HIGH



REF NO	TYPE	+5V	⊥
D7001	PCF8574	16	8
D7002	PCF8574	16	8

MAT 35598

Figure 10.1 Circuit diagram of front unit: key matrix

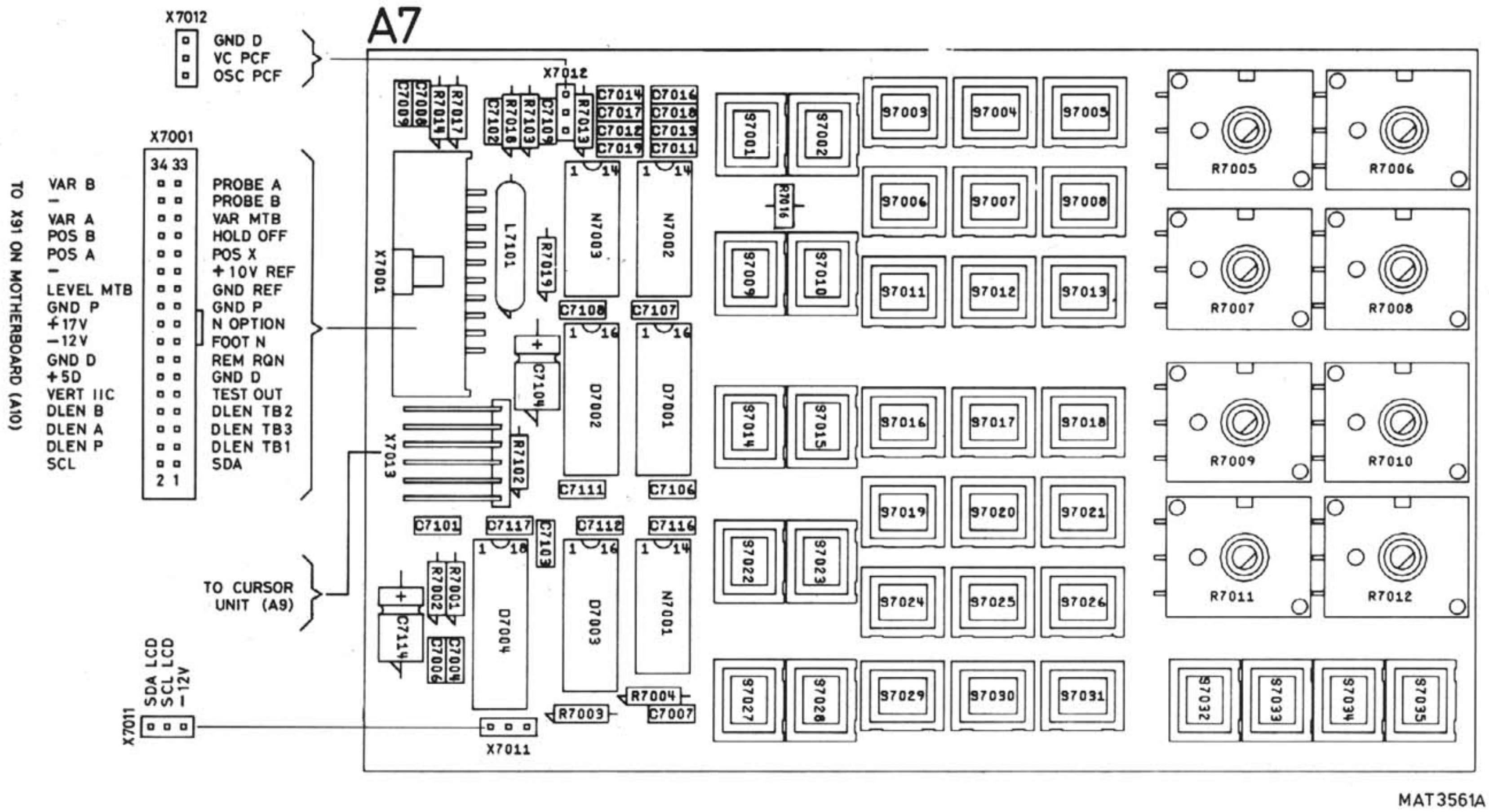
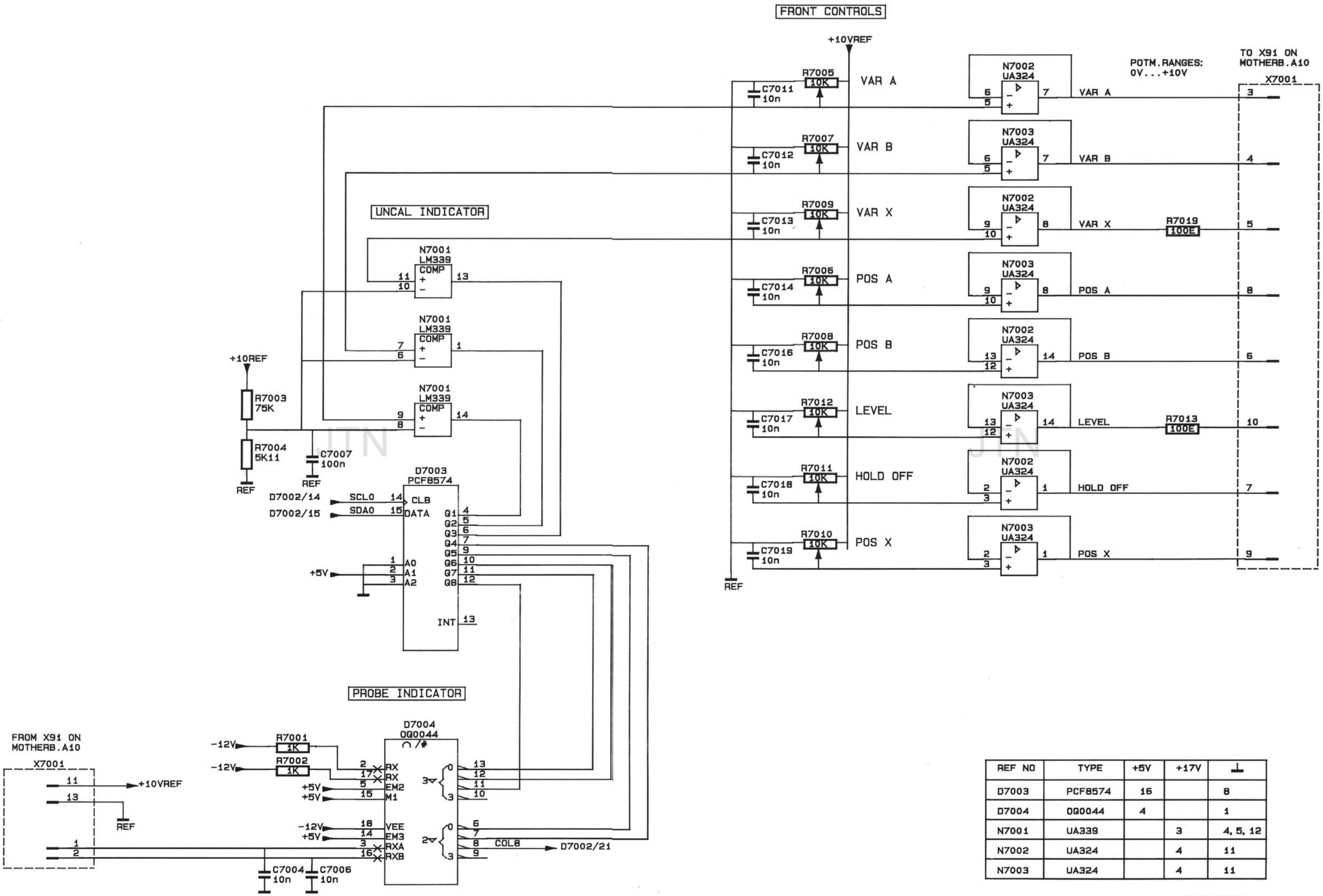


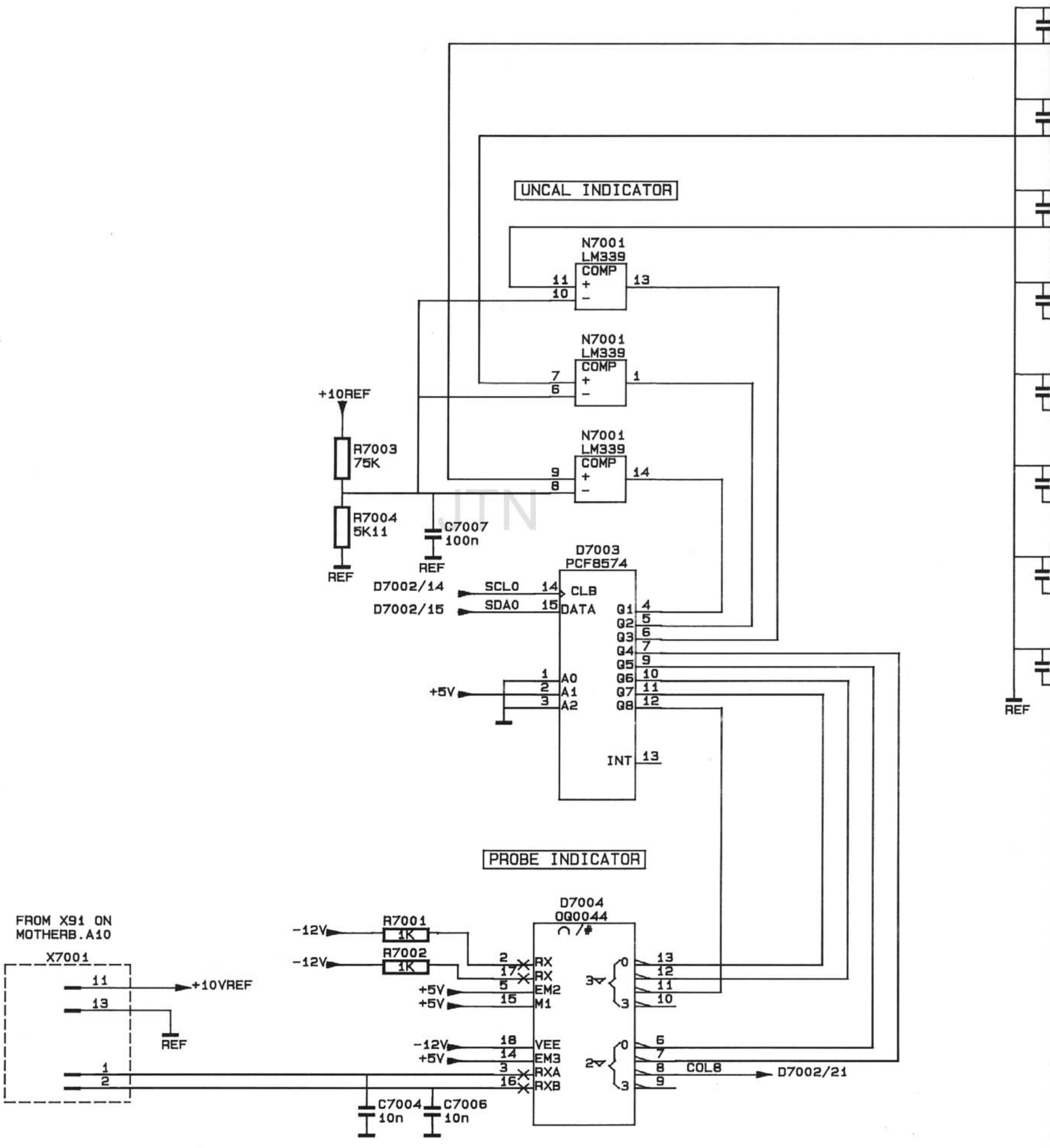
Figure 10.2 Front unit p.c.b.

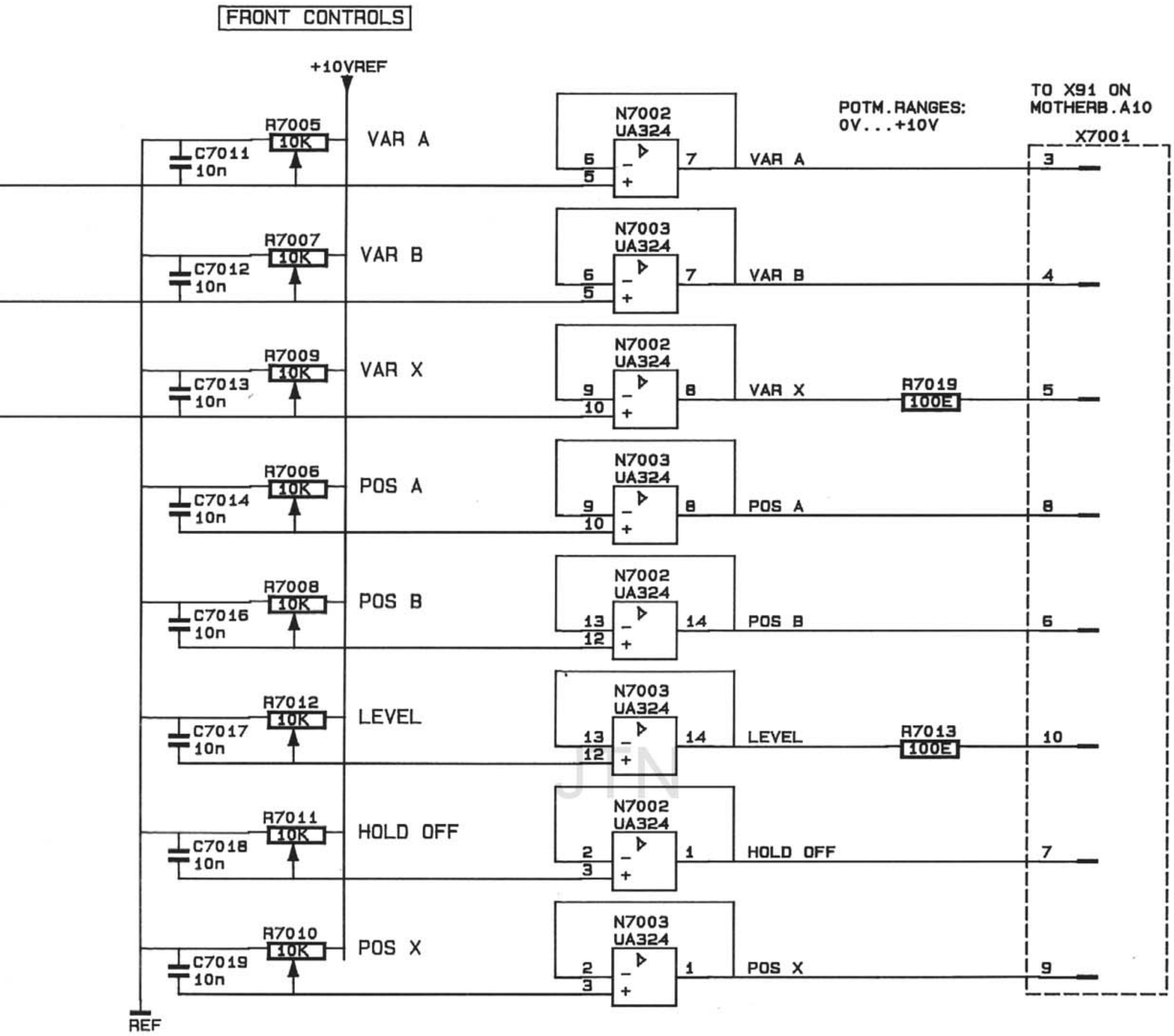


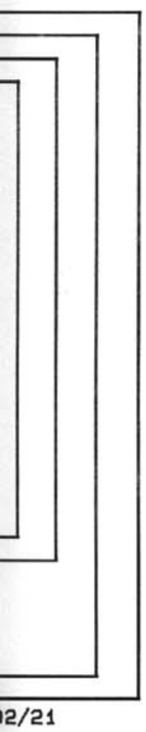
REF NO	TYPE	+5V	+17V	⊥
D7003	PCF8574	16		8
D7004	0Q0044	4		1
N7001	UA339		3	4, 5, 12
N7002	UA324		4	11
N7003	UA324		4	11

MAT 3560B

Figure 10.3 Circuit diagram of front unit: front controls and probe indication


UNCAL INDICATOR
N7001
LM339
COMP
+10REF
R7003
75K
R7004
5K11
C7007
100n
REF
D7003
PCF8574
D7002/14
SCL0
D7002/15
SDA0
CLB
DATA
A0
A1
A2
+5V
INT
PROBE INDICATOR
FROM X91 ON
MOTHERB.A10
X7001
+10VREF
-12V
R7001
1K
R7002
D7004
0Q0044
RX
EM2
M1
VEE
EM3
RXA
RXB
+5V
C7004
10n
C7006
COL8
D7002/21





REF NO	TYPE	+5V	+17V	⊥
D7003	PCF8574	16		8
D7004	0Q0044	4		1
N7001	UA339		3	4, 5, 12
N7002	UA324		4	11
N7003	UA324		4	11

MAT 3560B

Figure 10.3 Circuit diagram of front unit: front controls and probe indication

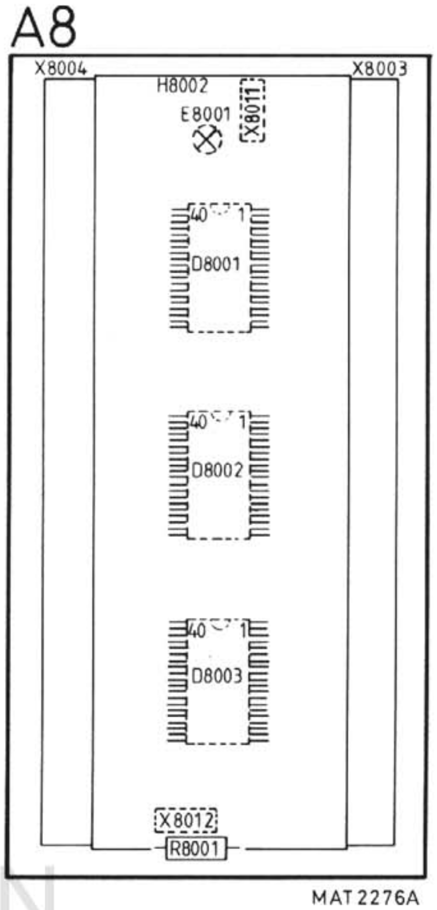
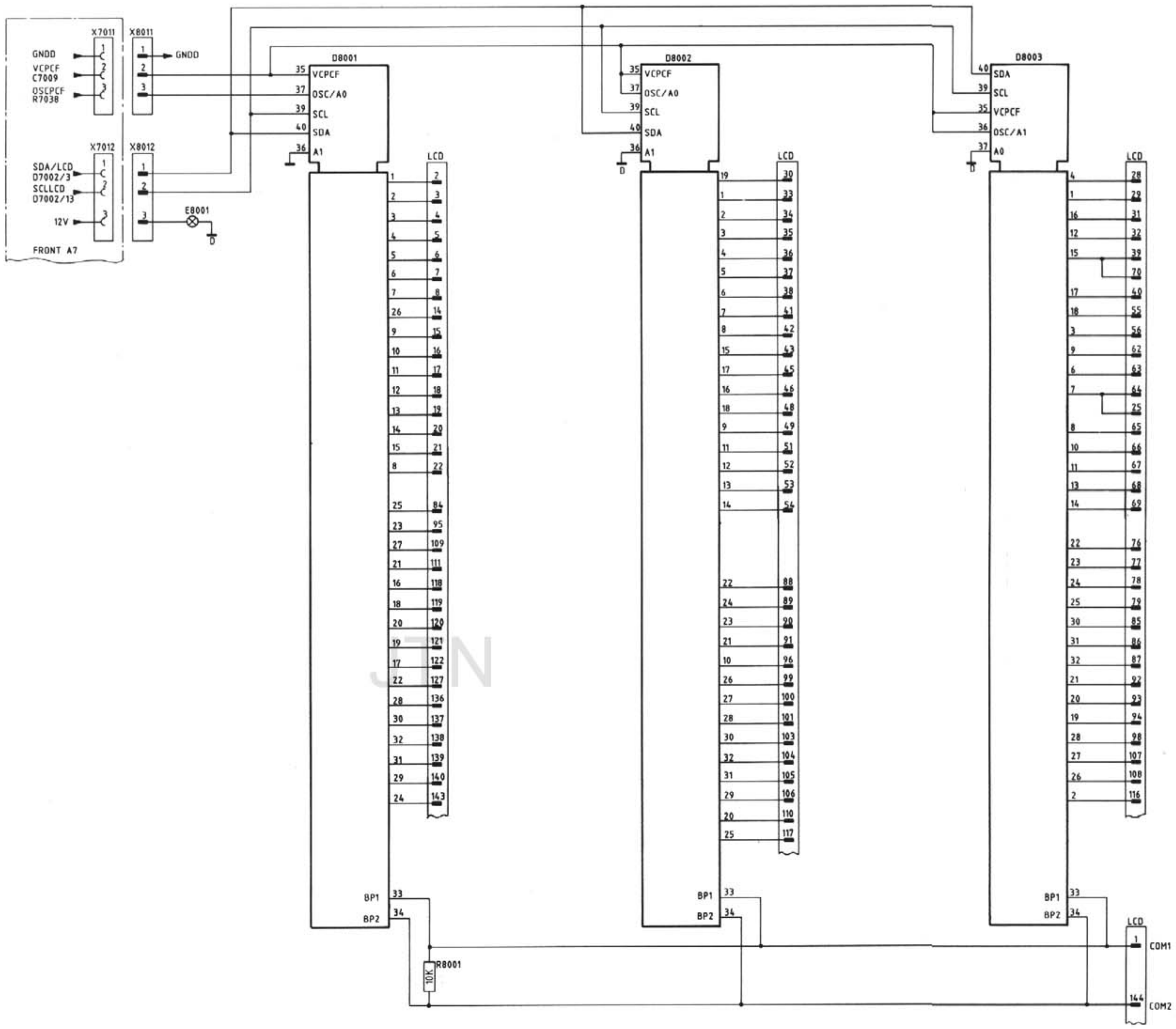


Figure 10.4 LCD unit p.c.b.



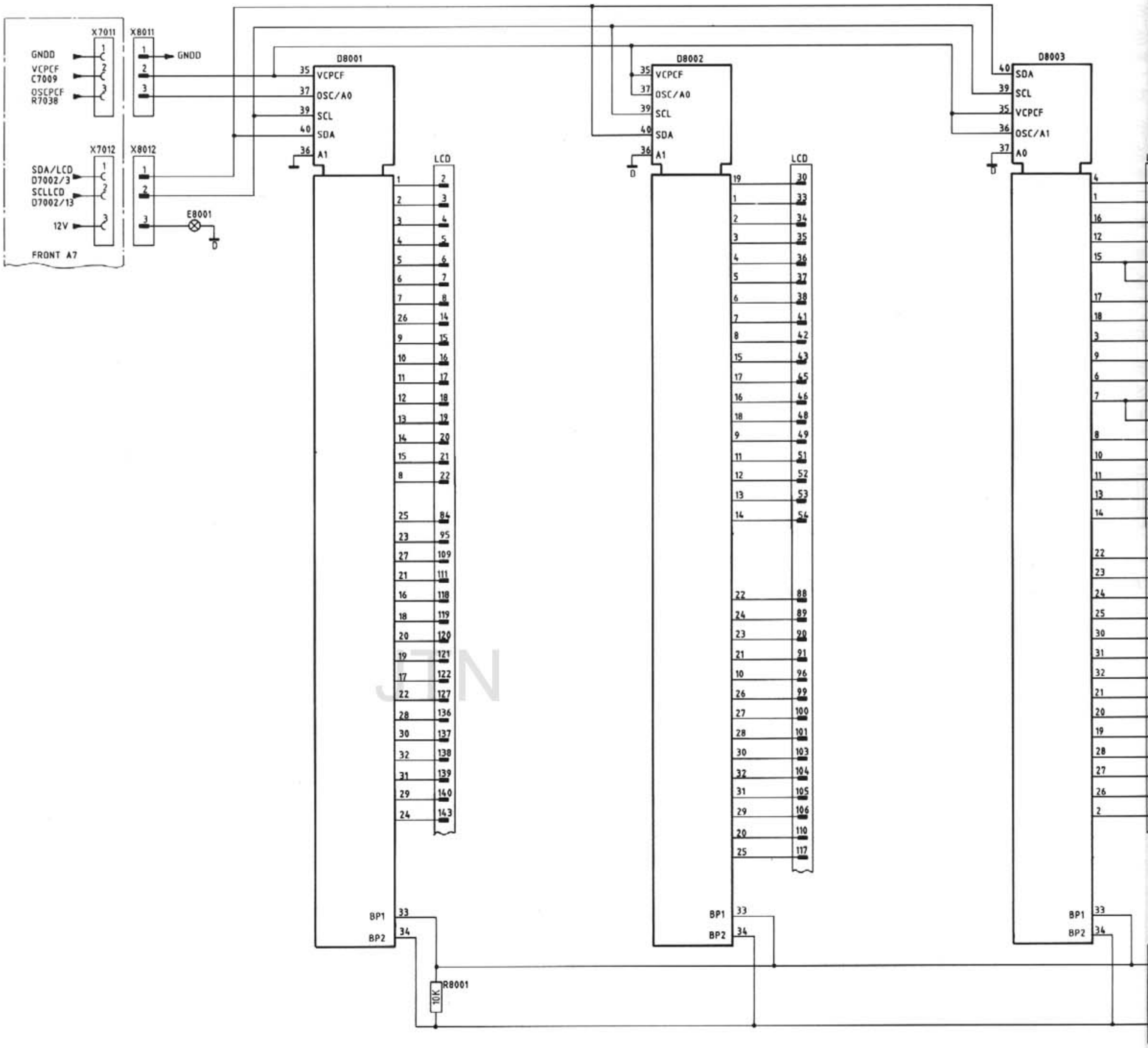
LCD				
	COM1		COM2	
PIN	DISPLAY	SEGMENT	DISPLAY	SEGMENT
144				COM2
143		x1		INV
142	NC		NC	
141	NC		NC	
140	1	a	1	f
139	1	g	1	e
138	1	c	1	d
137	1	b		P1
136		ALT		A
135	NC		NC	
134	NC		NC	
133	NC		NC	
132	NC		NC	
131	NC		NC	
130	NC		NC	
129	NC		NC	
128	NC		NC	
127		x2		INV
126	NC		NC	
125	NC		NC	
124	NC		NC	
123	NC		NC	
122	3	a	3	f
121	3	g	3	e
120	3	c	3	d
119	3	b		P2
118		TRIG D		NOT
117				TB
116		TRIG		AUTO
115	NC		NC	
114	NC		NC	
113	NC		NC	
112	NC		NC	
111		x4		x3
110	5	g	5	e
109	5	c	5	d
108	6	g	6	e
107	6	c	6	d
106	7	g	7	e
105	7	c	7	d
104		3		MAGN
103		2		4
102	NC		NC	
101		10		8
100		EXT		A
99		DC		P-P
98		y10,TV		y9
97				y7,y8
96		y4		y5,y6
95				DIGITAL MEMORY
94		y1		y2,y3
93	8	g	8	e
92	8	c	8	d
91	9	g	9	e
90	9	c	9	d
89	9	b		P6
88	10	g	10	e
87	10	c	10	d
86	10	b		P7
85	11	c	11	d
84		LOCK		REG
83	NC		NC	
82	NC		NC	
81	NC		NC	
80	NC		NC	
79		z2		z1
78		z3		z4
77		z6		z5
76				REMOTE
75	NC		NC	
74	NC		NC	
73	NC		NC	

LCD				
	COM1		COM2	
PIN	DISPLAY	SEGMENT	DISPLAY	SEGMENT
1		COM1		
2	2	a	2	f
3	2	b		
4	2	g	2	e
5	2	c	2	d
6		m		)
7		V		•<
8		DC		AC
9	NC		NC	
10	NC		NC	
11	NC		NC	
12	NC		NC	
13	NC		NC	
14		CHOP		B
15		ADD		LEVEL VIEW
16	4	a	4	f
17	4	b		
18	4	g	4	e
19	4	c	4	d
20		m		)
21		V		•<
22		DC		AC
23	NC		NC	
24	NC		NC	
25	NC		NC	
26	NC		NC	
27	NC		NC	
28		ARMED		‾‾‾‾
29		MULTI		X-DEFL
30		SINGLE		
31	5	a	5	f
32	5	b		P3
33	6	a	6	f
34	6	b		P4
35	7	a	7	f
36	7	b		
37		)		m
38		s		µ
39		s		
40		16		x9
41		x5		x8
42		x6		x7
43		LINE		DC
44	NC		NC	
45		B		AC
46		LF		HF
47	NC		NC	
48	8	a	8	f
49	8	b		P5
50	NC		NC	
51	9	a	9	f
52	10	a	10	f
53	11	a	11	f
54	11	b		
55	11	g	11	e
56		mV		DIV
57	NC		NC	
58	NC		NC	
59	NC		NC	
60	NC		NC	
61	NC		NC	
62		PLOT		ROLL
63		DOTS		STATUS
64		0,1/2,1,z17,z21		
65		z15		z16
66		z14		z13
67		z11		z12
68		z10		z9
69		z7		z8
70				MENU
71	NC		NC	
72	NC		NC	

MAT 3016
871016

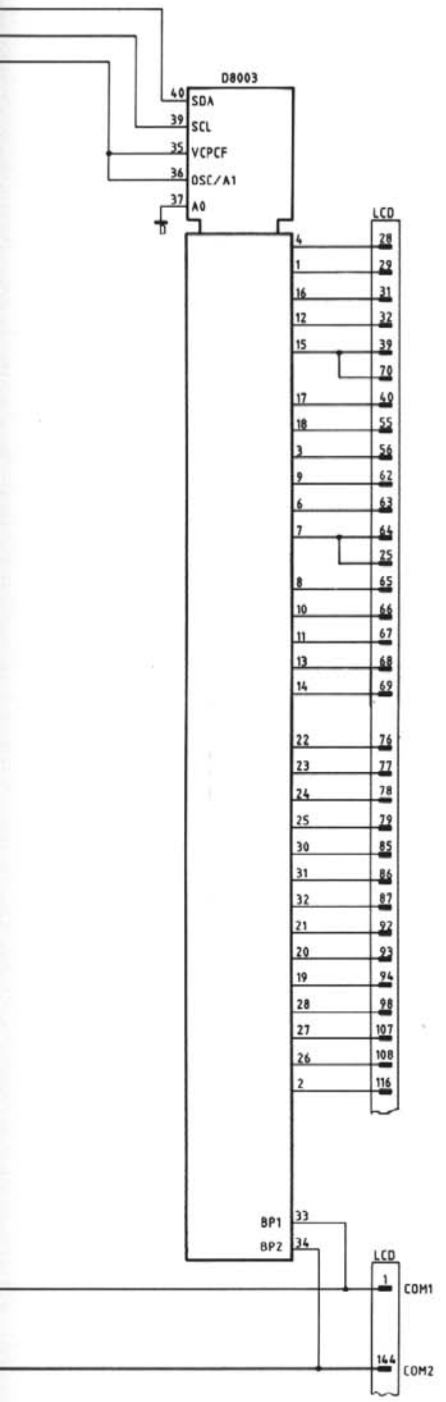
REF NO	TYPE	⏚
D8001	PCF8577	38
D8002	PCF8577	38
D8003	PCF8577	38

Figure 10.5 Circuit diagram of LCD unit



REF NO	TYPE	⏚ D
D8001	PCF8577	38
D8002	PCF8577	38
D8003	PCF8577	38

Fi



PIN	COM1 DISPLAY	COM1 SEGMENT	COM2 DISPLAY	COM2 SEGMENT
144				COM2
143		x1		INV
142	NC		NC	
141	NC		NC	
140	1	a	1	f
139	1	g	1	e
138	1	c	1	d
137	1	b		P1
136		ALT		A
135	NC		NC	
134	NC		NC	
133	NC		NC	
132	NC		NC	
131	NC		NC	
130	NC		NC	
129	NC		NC	
128	NC		NC	
127		x2		INV
126	NC		NC	
125	NC		NC	
124	NC		NC	
123	NC		NC	
122	3	a	3	f
121	3	g	3	e
120	3	c	3	d
119	3	b		P2
118		TRIG D		NOT
117				TB
116		TRIG		AUTO
115	NC		NC	
114	NC		NC	
113	NC		NC	
112	NC		NC	
111		x4		x3
110	5	g	5	e
109	5	c	5	d
108	6	g	6	e
107	6	c	6	d
106	7	g	7	e
105	7	c	7	d
104		3		MAGN
103		2		4
102	NC		NC	
101		10		8
100		EXT		A
99		DC		P-P
98		y10,TV		y9
97				y7,y8
96		y4		y5,y6
95				DIGITAL MEMORY
94		y1		y2,y3
93	8	g	8	e
92	8	c	8	d
91	9	g	9	e
90	9	c	9	d
89	9	b		P6
88	10	g	10	e
87	10	c	10	d
86	10	b		P7
85	11	c	11	d
84		LOCK		REG
83	NC		NC	
82	NC		NC	
81	NC		NC	
80	NC		NC	
79		z2		z1
78		z3		z4
77		z6		z5
76				REMOTE
75	NC		NC	
74	NC		NC	
73	NC		NC	

H8002

PIN	COM1 DISPLAY	COM1 SEGMENT	COM2 DISPLAY	COM2 SEGMENT
1		COM1		
2	2	a	2	f
3	2	b		
4	2	g	2	e
5	2	c	2	d
6		rf		)
7		V		•<
8		DC		AC
9	NC		NC	
10	NC		NC	
11	NC		NC	
12	NC		NC	
13	NC		NC	
14		CHOP		B
15		ADD		LEVEL VIEW
16	4	a	4	f
17	4	b		
18	4	g	4	e
19	4	c	4	d
20		rf		)
21		V		•<
22		DC		AC
23	NC		NC	
24	NC		NC	
25	NC		NC	
26	NC		NC	
27	NC		NC	
28		ARMED		—
29		MULTI		X-DEFL
30		SINGLE		
31	5	a	5	f
32	5	b		P3
33	6	a	6	f
34	6	b		P4
35	7	a	7	f
36	7	b		
37		)		rf
38		s		µ
39		s		
40		16		x9
41		x5		x8
42		x6		x7
43		LINE		DC
44	NC		NC	
45		B		AC
46		LF		HF
47	NC		NC	
48	8	a	8	f
49	8	b		P5
50	NC		NC	
51	9	a	9	f
52	10	a	10	f
53	11	a	11	f
54	11	b		
55	11	g	11	e
56		mV		DIV
57	NC		NC	
58	NC		NC	
59	NC		NC	
60	NC		NC	
61	NC		NC	
62		PLOT		ROLL
63		DOTS		STATUS
64		0,1/2,1,z17,z21		
65		z15		z16
66		z14		z13
67		z11		z12
68		z10		z9
69		z7		z8
70				MENU
71	NC		NC	
72	NC		NC	

MAT3016
871016

Figure 10.5 Circuit diagram of LCD unit

11 MOTHERBOARD UNIT (A10)

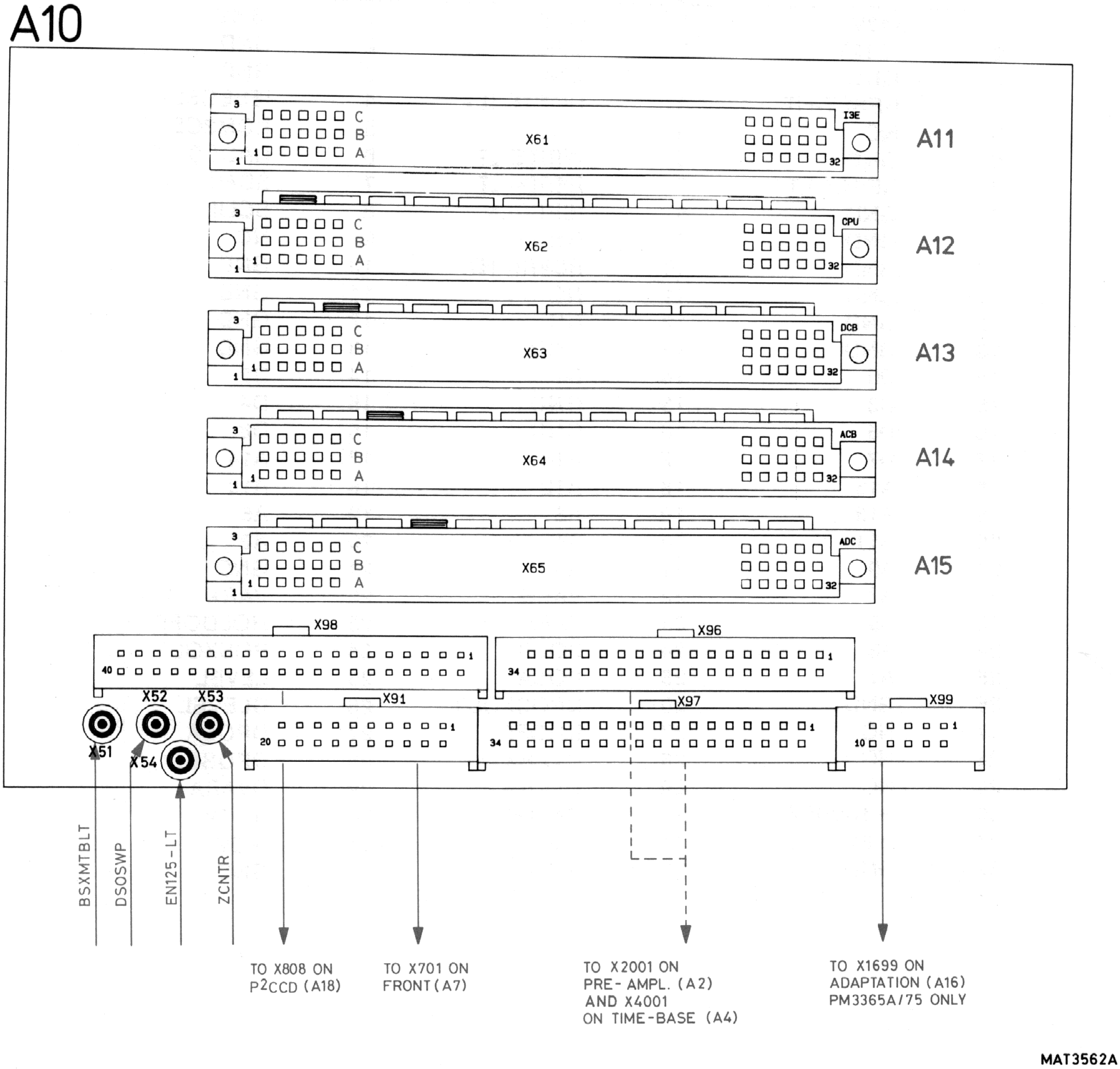


Figure 11.1 Motherboard unit p.c.b.

A complete signal name list of all motherboard connectors is given on the next pages.

Attention: *Flat cable A101 is connected to X97 if no option is installed in socket X61,*
Flat cable A101 is connected to X96 if an IEEE-488 or a RS232 option is installed in socket X61.

X61: Socket for A11, IEEE-488 or RS232 unit (optional)
X62: Socket for A12, Central Processor (CPU) unit
X63: Socket for A13, Digital Control Logic (DCL) unit
X64: Socket for A14, Acquisition Control logic (ACL) unit
X65, Socket for A15, Analog to Digital and Digital to Analog Converter (ADC-DAC) unit

CONNECTOR PINNINGS X61

A		B		C	
1	-17V	1	GND	1	-6,4V
2	+12T	2	GND	2	GND
3	GND	3	GND	3	GND
4	RESET-HT	4	DGPTCSLT	4	IEEECSLT
5	NC	5	NC	5	ROM2CSLT
6	GND	6	WRITE-LT	6	DACCS-LT
7	RESET-LT	7	READ--LT	7	SDA0
8	GND	8	IEEECLK	8	SCL0
9	GND	9	GND	9	NC
10	GND	10	RDWR--HT	10	GND
11	GND	11	NC	11	GND
12	GND	12	NC	12	GND
13	GND	13	GND	13	GND
14	D0	14	D1	14	D2
15	D3	15	GND	15	D4
16	D5	16	GND	16	D6
17	D7	17	A16	17	A14
18	A15	18	A12	18	A10
19	A13	19	A8	19	A6
20	A11	20	A4	20	A2
21	A9	21	A0	21	GND
22	A7	22	VARB	22	VARX
23	A5	23	VARA	23	HOLDOFF
24	A3	24	POSB	24	POSXOUT
25	A1	25	POSA	25	LEVEL
26	GND	26	DPOSXOUT	26	DLEVEL
27	NC	27	DHOFF	27	DPOSA
28	NC	28	DVARX	28	DPOSB
29	NC	29	DVARB	29	DVARA
30	+10VREF	30	GNDREF	30	+17V
31	+5V	31	+5V	31	+5V
32	GND	32	GND	32	GND

CONNECTOR PINNINGS X62

A		B		C	
1	SCL	1	SRTTB-LT	1	RDADD-LT
2	RESET-HT	2	GND	2	GND
3	DCCLK	3	DTTC--LT	3	MEMON-LT
4	GND	4	DGPTCSLT	4	IEEECSLT
5	DELTRGHT	5	GND	5	ROM2CSLT
6	RSTACQLT	6	WRITE-LT	6	DACCS-LT
7	RESER-LT	7	READ--LT	7	SDA0
8	DSOCLK	8	IEEECLK	8	SCL0
9	DSPINTLT	9	TBSTNCHT	9	GND
10	SWR---HT	10	SWTBCLKT	10	DSOACKLT
11	ENCVCNHT	11	SWTBCLK	11	DSOCS-LT
12	CVCNRYLT	12	GND	12	DTST--LT
13	RDWR--HT	13	GND	13	GND
14	D0	14	D1	14	D2
15	D3	15	GND	15	D4
16	D5	16	NC	16	D6
17	D7	17	NC	17	A16
18	A15	18	NC	18	A14
19	A13	19	GND	19	A12
20	A11	20	GND	20	A10
21	A9	21	GND	21	A8
22	A7	22	GNDB	22	A6
23	A5	23	NC	23	A4
24	A3	24	NC	24	A2
25	A1	25	DLENY-HT	25	A0
26	DLENX-HT	26	GND	26	DLENB-HT
27	DLENA-HT	27	TESTO-HT	27	VERIICHT
28	DLENP-HT	28	DLENT2HT	28	DLENT1HT
29	SDA1	29	EDC---LT	29	SCL1
30	+10VREF	30	GNDREF	30	+17V
31	+5V	31	+5V	31	+5V
32	GND	32	GND	32	GND

CONNECTOR PINNINGS X63

A		B		C	
1	SCL	1	GND	1	RES5
2	RESET-HT	2	GND	2	BATT
3	TBWE--HT	3	DCWE--HT	3	STWE--HT
4	PENLFT	4	GND	4	MEMON-HT
5	PLOT--HT	5	DELTRGHT	5	DOTS--LT
6	ZON---LT	6	NC	6	SC0---HT
7	OSCON-LT	7	NC	7	RESET-LT
8	TCINN-HT	8	TRIGENHT	8	DSOCLK
9	INVA0-HT	9	DATEN-HT	9	DSPINTLT
10	MIDCLKHT	10	XYDLE-HT	10	DSOCS-LT
11	RES7	11	OLCLK	11	DSOCS-LT
12	WRSMP-HT	12	MDOE--LT	12	DTST--LT
13	RSTH--LT	13	POSXOFHT	13	RDWR--HT
14	GND	14	D1	14	D0
15	GND	15	D3	15	D2
16	PD0	16	PD1	16	D4
17	PD2	17	PD3	17	D5
18	PD4	18	PD5	18	D6
19	PD6	19	PD7	19	D7
20	XDAC0	20	SC1---HT	20	GND
21	XDAC1	21	GND	21	A16
22	XDAC2	22	A15	22	A14
23	XDAC3	23	A13	23	A12
24	XDAC4	24	A11	24	A10
25	XDAC5	25	A9	25	A8
26	XDAC6	26	A7	26	A6
27	XDAC7	27	A5	27	A4
28	XDAC8	28	A3	28	A2
29	XDAC9	29	A1	29	A0
30	RES1	30	RES2	30	GND
31	+5V	31	+5V	31	+5V
32	GND	32	GND	32	GND

CONNECTOR PINNINGS X64

A		B		C	
1	SCL	1	GND	1	RES5
2	RESET-HT	2	GND	2	MEMON-HT
3	CDRD--HT	3	TCEV--LT	3	SWCK
4	RSSW--HT	4	DISOD-HT	4	INTOD-HT
5	PLOT--HT	5	DELTRGHT	5	DOTS--LT
6	EDC---LT	6	RSTEV-LT	6	RSTOD-LT
7	BSXMTBLT	7	SC0---HT	7	DISEV-HT
8	OSCON-LT	8	TCINN-HT	8	TRIGENHT
9	RSTACQLT	9	INVA0-HT	9	DATEN-HT
10	DTUF--HT	10	MIDCLK	10	XYDLE-HT
11	SRTACQHT	11	RES7	11	OLCLK
12	CHB---LT	12	WRSMP-HT	12	MDOE--LT
13	GND	13	RSTH--LT	13	GND
14	CHA---LT	14	SWR---HT	14	TBSYNCHT
15	NC	15	ENCVCNHT	15	SWTBCLK
16	STCONVLT	16	CVCNRYLT	16	SWTB
17	CHSEL1HT	17	CHSEL0HT	17	NC
18	AD1	18	AD0	18	SDA1
19	AD3	19	AD2	19	SCL1
20	AD5	20	AD4	20	SC1---HT
21	AD7	21	AD6	21	NC
22	YDAC0	22	ED0	22	PD0
23	YDAC1	23	ED1	23	PD1
24	YDAC2	24	ED2	24	PD2
25	YDAC3	25	ED3	25	PD3
26	YDAC4	26	HOLDB-LT	26	PD4
27	YDAC5	27	SRTTB-LT	27	PD5
28	YDAC6	28	SRTMTBHT	28	PD6
29	YDAC7	29	CCDENBHT	29	PD7
30	RES1	30	RES2	30	DLENX-HT
31	+5V	31	+5V	31	+5V
32	GND	32	GND	32	GND

CONNECTOR PINNINGS X65

A		B		C	
1	GND	1	+5A	1	-6,4V
2	GND	2	+5A	2	+5A
3	MEMON-HT	3	BATT	3	+12T
4	GNDP2	4	GNDP2	4	GNDP2
5	+YDAC	5	GNDP2	5	-YDAC
6	GNDP1	6	GNDP1	6	GNDP1
7	CHAEV	7	GNDP1	7	CHAOD
8	GNDA	8	GNDA	8	GNDA
9	CHBEV	9	GNDA	9	CHBOD
10	GNDB	10	GNDB	10	GNDB
11	ZCNTR	11	GNDB	11	DSOSWP
12	PLOT--HT	12	AIN4	12	DOTS--LT
13	ZON---LT	13	GND	13	SC0---HT
14	POSXOFHT	14	GND	14	PENLFT
15	POSX	15	+17V	15	STCONVLT
16	POSXOUT	16	GND	16	CHSEL1HT
17	AD1	17	GND	17	CHSEL0HT
18	AD3	18	GND	18	AD0
19	AD5	19	GND	19	AD2
20	AD7	20	GND	20	AD4
21	XDAC0	21	GND	21	AD6
22	XDAC1	22	GND	22	YDAC0
23	XDAC2	23	NC	23	YDAC1
24	XDAC3	24	NC	24	YDAC2
25	XDAC4	25	GND	25	YDAC3
26	XDAC5	26	GND	26	YDAC4
27	XDAC6	27	GND	27	YDAC5
28	XDAC7	28	GND	28	YDAC6
29	XDAC8	29	GND	29	YDAC7
30	XDAC9	30	+10VREF	30	-12V
31	+5V	31	+5V	31	+5V
32	GND	32	GND	32	GND

CONNECTOR PINNINGS X91

1	PRBA	2	PRBB
3	VARA	4	VARB
5	VARX	6	POSB
7	HOLDOFF	8	POSA
9	POSX	10	LEVEL
11	+10VREF	12	+17V
13	GND REF	14	- 12 V
15	GND	16	GND
17	+5V	18	+5V
19	SCL0	20	SDA0

CONNECTOR PINNINGS X96 AND X97

1	SDA	2	SCL
3	DLEN TB1	4	DLEN P
5	DLEN TB3	6	DLEN A
7	DLEN TB3	8	DLEN B
9	TEST OUT	10	VERT IIC
11	GND D	12	+ 5D
13	REMRQN	14	GND D
15	FOOTN	16	- 12V
17	STRACQHT	18	+ 17V
19	GND P	20	GND P
21	GND REF	22	LEVEL MTB
23	+ 10VREF	24	--
25	POS X	26	POS A
27	HOLD OFF	28	POS B
29	VAR MTB	30	VAR A
31	PROBE B	32	SRTMTBHT
33	PROBE A	34	VAR B

CONNECTOR PINNINGS X98

1	GNDB	2	CHBEV
3	CHBOD	4	GNDA
5	CHAOD	6	CHAEV
7	GNDP1	8	+YDAC
9	-YDAC	10	GNDP2
11	MEMON-HT	12	RSTOD-LT
13	DISEV-HT	14	RSTEV-LT
15	SWTB	16	DISOD-HT
17	INTEV-HT	18	INTOD-HT
19	SAMPLEHT	20	CDRD--HT
21	DCCLK	22	TCEV--LT
23	ED3	24	DTUF--LT
25	ED2	26	EDC---LT
27	ED1	28	DTTC--LT
29	ED0	30	RSSW--HT
31	DCWE--HT	32	SWCK
33	OSCON-LT	34	TBWE--HT
35	+12T	36	STWE--HT
37	+5A	38	-17V
39	-6,4V	40	GND

CONNECTOR PINNINGS X99

1	+17V	2	CCDENBHT
3	HOLDB-LT	4	GND
5	CHA---LT	6	+5V
7	CHB---LT	8	GND
9	ADCIN4	10	GNDP

50 OHM CONNECTOR PINNINGS

X51	BSXMTBLT
X52	DSOSWP
X53	ZCNTR
X54	EN125-LT (PM3355/57 only)

12 OPTIONS (A11)

The optionslot on the Motherboard (connector X65) is reserved for optional expansions for this instrument.
Description of the option will be given in separate manuals.

13 CPU UNIT (A12)

13.1 INTRODUCTION

This unit mainly consists of a powerful 68008 microprocessor configuration with PROM, address decoders, I/O buffers and a clock generator. The microprocessor runs at a clock frequency of 8 MHz. The microprocessor has an asynchronous bus structure with a 20-bit address bus and an 8-bit databus. Asynchronous means that the microprocessor waits for a "data acknowledge" signal before continuing. This enables the microprocessor to handle different access times in the circuit.
To provide specific serial data transfer possibilities, the microprocessor system also contains an I^2C bus interface.
The I^2C bus is for 2-way, 3-line communication between different ICs or modules. The three lines are a serial data line (SDA), a serial clock line (SCL) and ground. The SDA and SCL lines must be connected to a positive supply via pull-up resistors when connected to the output stages of a device. Data transfer may be initiated only when the bus is not busy.

13.2 MEMORY MAP

Only a part of the complete address range is used, according to the following memory map. The map gives also the memory select signals, generated by device D201.

Address (hex)		Decoding		Signal	Connected to
00000 1FFFF		ROM1		ROM1CSLT	D216-24
20000 3FFFF		ROM2 (not used)		ROM2CSLT	--
40000 5FFFF	40000 48000 50000 58000	RDIC0-LT RDIC1-LT -- RSPLT-LT	WRIIC-LT MFOUT-LT -- --	MFIOCSLT	D202-4
60000 7FFFF		RAM		RAMCS-LT	D217-20
80000 9FFFF		IEEE or RS232 (optional)		IEEECSLT	D116-8
A0000 BFFFF		TIMER		TMRCS-LT	D218-21
C0000 DFFFF	C0000 D0000	Digital control DAC		DCPTCSLT	D213-1 and D213-12
E0000 FFFF		various		DSOCS-LT	D314-7

The signal MFIOCSLT is decoded again by D202. When RDWR--HT is high, this determines the read status of the decoded signals; when it is low this determines the write status. The coding of MFIOCSLT is as follows:

Address range (Hex)	Read	Write
40000-47FFF	RDIC0-LT	WRIIC-LT
48000-4FFFF	RDIC1-LT	MFOUT-LT
50000-57FFF	--	--
58000-5FFFF	RSPLT-LT	--

The signal DCPTCSLT is decoded by D213 and, controlled by A16, gives the DACCS-LT and DGPTCS-LT signals.

The signal DSOCS-LT is applied to the DCL unit A13 and selects among other things the acquisition RAM or the display RAM.

13.3 CIRCUIT DESCRIPTION

The **MICROPROCESSOR** D214 is connected via the DATA bus D0...D7 to the **PROM** D216, to the **RAM** D217, to the **TIMER** D218 and to the DCL unit A13.
D216 contains 128K x 8 Read Only Memory, while D217 contains 8K x 8 Random Access Memory. Both devices are addressed via the ADDRESS bus.

The **TIMER** D218 consists of three separate timers which are controlled by the microprocessor:

- GATE 0 forms the delay counter (not active!)
- GATE 1 forms the read-out counter
- GATE 2 forms the slow time base counter

After the timer has counted the value determined by the value on the data bus, the output becomes low.

ATTENTION: Because for this instrument (PM3350A/55) the delay counter is formed by D441, D442, D443 and D444 on unit A14, output signal DTTC--LT has been disabled by the removing of resistor R229. However, this board can also been used for servicing older instruments (PM3350) by means of inserting R229. Take notice that in older instruments unit A14 must be of an older type, so without D441 ... D444.

The **C-BUS DECODER** decodes the DLEN signals for the various circuits at the time that the signal MFOUT-LT is low.
It gives the following decoding:

Address (Hex)	Signal
48000	DLENP-HT
48001	DLENT1-HT
48002	DLENT2-HT
48003	VERIIC-HT
48004	N.C.
48005	DLENB-HT
48006	DLENX-HT
48007	DLENA-HT

Note that for servicing, soldering joints are added in the p.c.b. tracks connecting the circuits. These can be used to localize a fault in the I^2C bus by means of interrupting the bus connection.

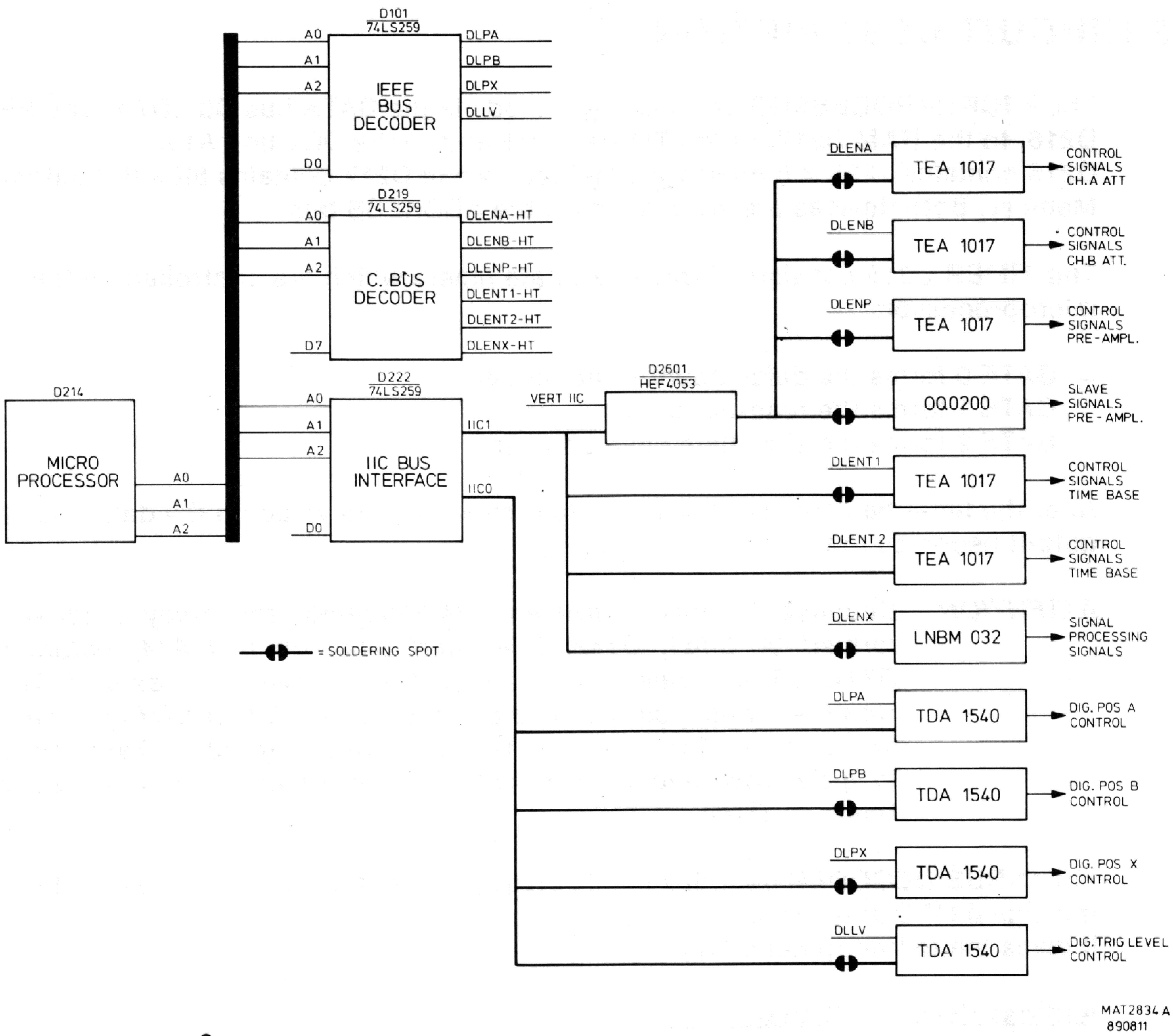


Figure 13.1 I^2C bus structure

The I^2C **BUS INTERFACE** D222 decodes the I^2C bus and other signals at the time when WRIIC-LT is low. It gives the following decoding:

Address	Signal	Description
40000	SDA	Serial data
40001	SCL	Serial clock
40002	SEL0	Selection I^2C bus 0
40003	SEL1	Selection I^2C bus 1
40004	--	--
40005	RSNT-HT	Resets 20 ms timer D207
40006	WTDG-HT	Watchdog control
40007	MEMON-HT	Memory on signal

Next the signals SDA, SCL, SEL0 and SEL1 are decoded to the I^2C 0 bus and I^2C 1 bus by D223.

The **STATUS INPUT** device D221 serves as an input port to read the following status info:

- SWR---HT , sweep ready
- DELTRGLT , indication for delay trigger input
- SCL 1 ,
- SDA 1 , indication for I^2C 1 bus
- SDA 0 ,
- SCL 0 , indication for I^2C 0 bus
- TEST0-HT , indication for triggered mode
- EDC---LT , enable delay counter

When the enable inputs RDICO-LT and RDIC1-LT become low, the status input is read and copied in the accumulator of the microprocessor via the data bus.

The **CLOCK GENERATOR** consists of a complete integrated oscillator of 16 MHz (G201) and a number of divider stages.
The table below gives the frequency of the generated signals.

Name	Frequency
DSOCLK	16 MHz
CPUCLK	8 MHz
IEEECLK	8 MHz
INTCLK	32 kHz

The **20 ms INTERRUPT** device D207 interrupts the microprocessor each 20 ms so that a new screen can be written.

The **DTACK GENERATOR** basically consists of D212, D209 and D211.

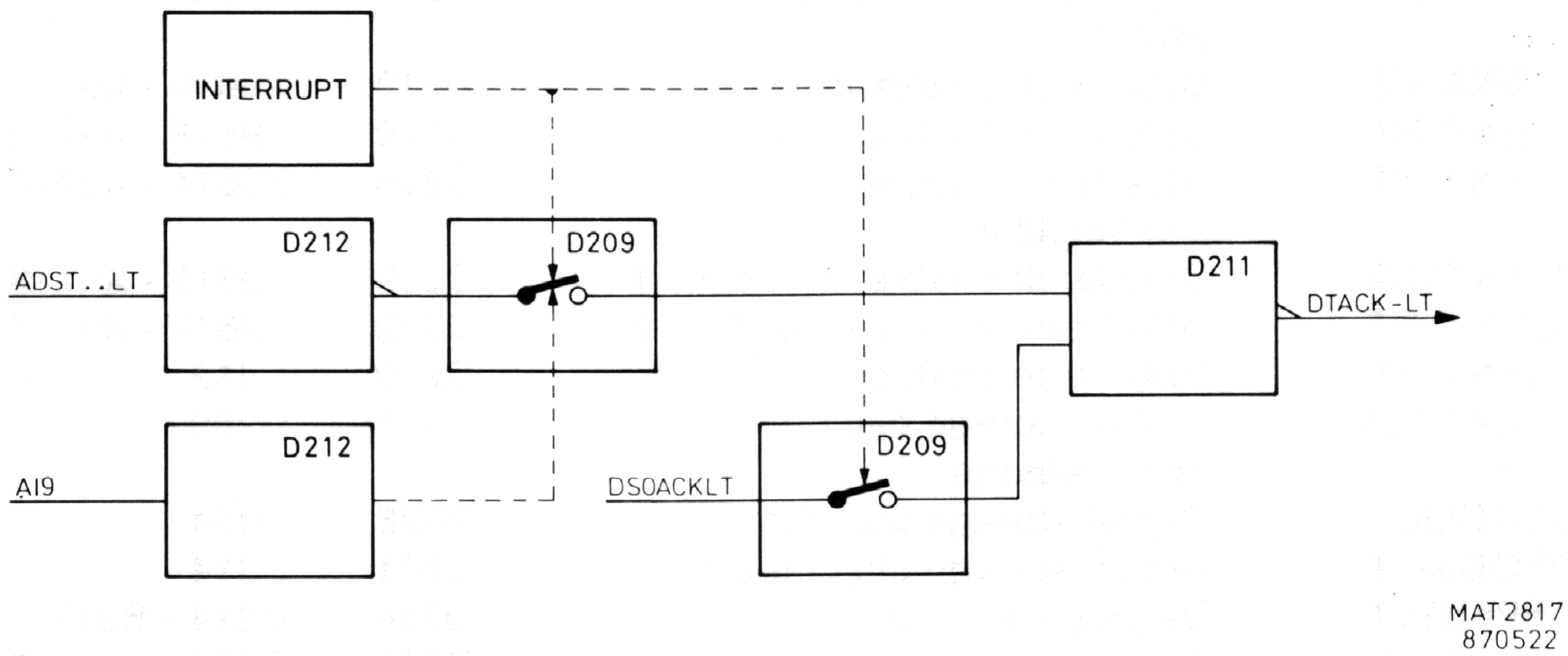


Figure 13.2 DTACK generator

The microprocessor generates the address strobe ADST--LT as a message that the address put on the address bus is valid. This signal is applied to D212-3 and converted into the data acknowledge DTACK-LT signal.This signal indicates that the data is valid. The DTACK-LT signal can be interrupted in two ways:

- display interrupt; this starts writing a new trace A, B, RA or RB.
  Now FC0, FC1 and FC2 are high with the result that a low level is applied to D209-13. This blocks the ADST path.

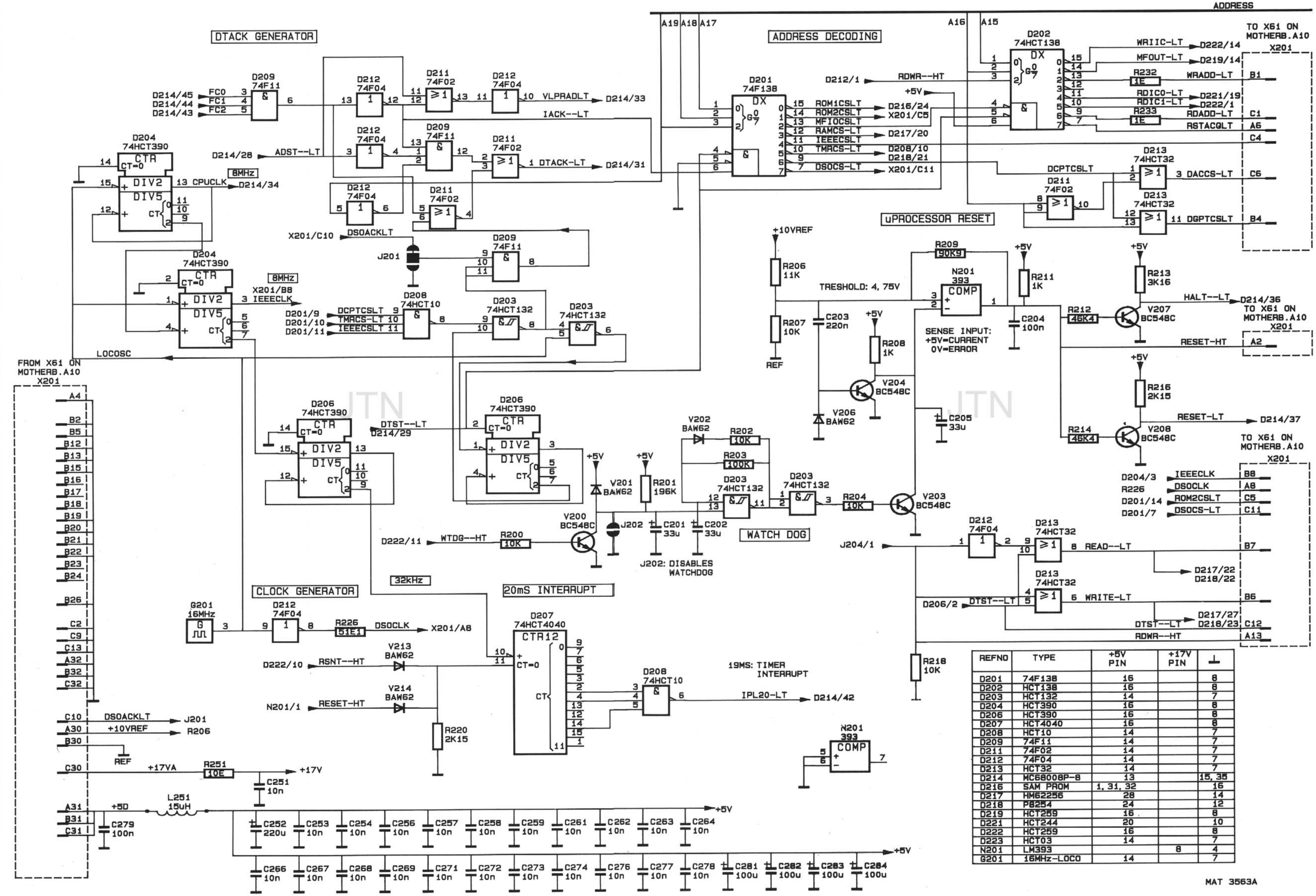
- 20 ms interrupt, this starts writing a new screen. When address line A19 is high, a low level is applied to D209-2 which also blocks the ADST path. Now DSOACKLT controls the DTACK-LT pulse via D211-3 or D206 takes care for a peripheral acknowledge.

The **MICROPROCESSOR RESET** circuit consists of the power-up reset and the watchdog circuit.
After switching-on, transistor V204 conducts so that the RESET-LT and HALT-LT signals are low, initiating the main program. After the supply voltages are within their specifications the signals are released and the microprocessor is ready for use.
The WATCHDOG is a facility to control the correct function of the software. In normal condition the WTDG--HT is low; this causes capacitor C201 to charge. But each 1,5 s the WTDG--HT is high for a short moment so that C201 is discharged again. When the WTDG--HT signal is not active (low), C201 will charge until D203-13 is high so that D203-11 goes high. This results in V203 conducting so HALT-LT and RESET-LT become low, thus initiating the main program again.

13.4 SIGNAL NAME LIST

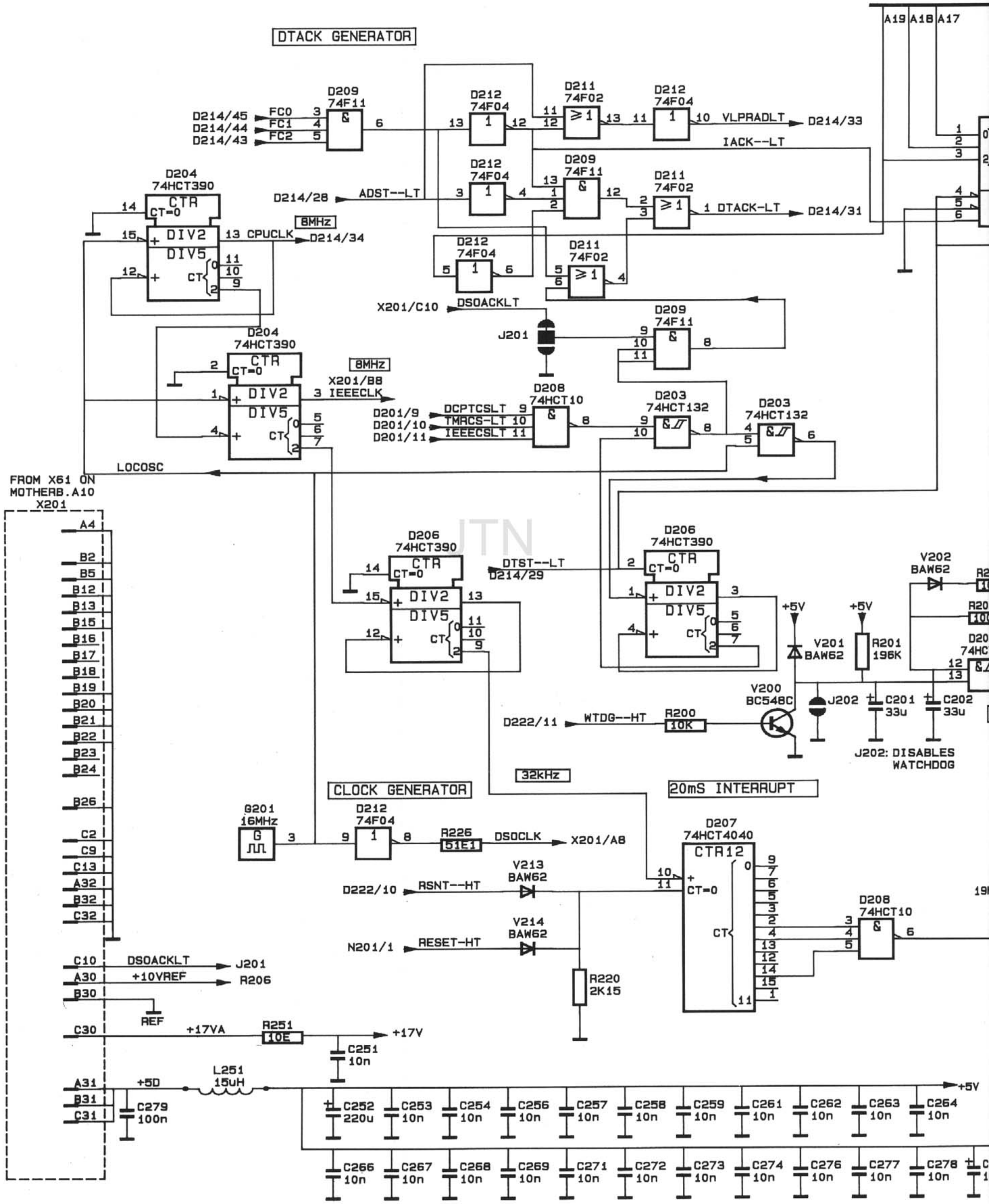
Signal name	Description	Signal source	Signal destination(s)
A0...16	Address bus	D214	D216 - D217 - D301 - D302 - D316 - D307 - D318
ADST-LT	Address strobe	D214	D212
CPUCLK	CPU clock	D204	D214
CVCNRYLT	Conversion counter ready	D218	D403 - D406
D0...7	Data bus	D214	D218 - D303 - D216 - D217 - D221
DACCS-LT	Digital analog conversion chip select	D213	D101
DCCLK	Delay counter clock	R886	D218
DELTRGHT	Delay trigger	D314	D221 - D402
DGPTCSLT	Digital pot.meter chip select	D213	D102
DLENA-HT	Data latch enable ch. A	D219	X9616 - X9716
DLENB-HT	Data latch enable ch. B	D219	X9618 - X9718
DLENP-HT	Data latch enable pre-amplifier	D219	X9614 - X9714
DLENT1HT	Data latch enable time-base 1	D219	X9613 - X9713
DLENT2HT	Data latch enable time-base 2	D219	X9617 - X9717
DLENX-HT	Data latch enable X	D219	D412
DSOACKLT	Digital storage osc. acknowledge	D314	D209
DSOCLK	Digital storage osc. clock	R226	D314
DSOCS-LT	Digital storage chip select	D201	D314
DSPLNTLT	Display interrupt	D314	D214 - R217
DTACK-LT	Data acknowledge	D211	D214
DTST-LT	Data strobe	D214	D201 - D202 - D206 D213 - D314 - D316
DTTC-LT	Delay trigger terminal count	D218	D801
EDC--LT	Enable delay counter	R401	D221 - D801
ENCVCNHT	Enable conversion counter	D406	D218
FC0...2	Functional code 0...2	D214	D209
HALT-LT	Halt	V207	D214
IACK-LT	Interrupt acknowledge	D212	D201 - D209 - D211
IEEECLK	IEEE clock	D204	D116
IEEECSLT	IEEE chip select	D201	D208
IPL20-LT	Interrupt priority level	D208	D214
MFIOCSLT	MF input/output chip select	D201	D202
MFOUT-LT	MF output enable	D202	D219
MEMON-HT	Memory on	D222	R601 - R602
RAMCS-LT	Ram chip select	D201	D217
RDIC0-LT	Read IIC bus 0	D202	D221
RDIC1-LT	Read IIC bus 1	D202	D221
RDWR-HT	Read/ Write	D303	D212 - D214 - D306 - D309
READ-LT	Read	D213	D218
RESET--HT	Reset	N201	D116 - D314 - D318
RESET-LT	Reset	V208	R191 - D214 - D318
ROM1CS-LT	ROM 1 chip select	D201	D216
ROM2CS-LT	ROM 2 chip select	D201	--
RSNT-HT	Reset interrupt	D222	D207
RSTACQLT	Reset acquisition	D202	D402 - D403
SCL	Serial clock	D222	D223

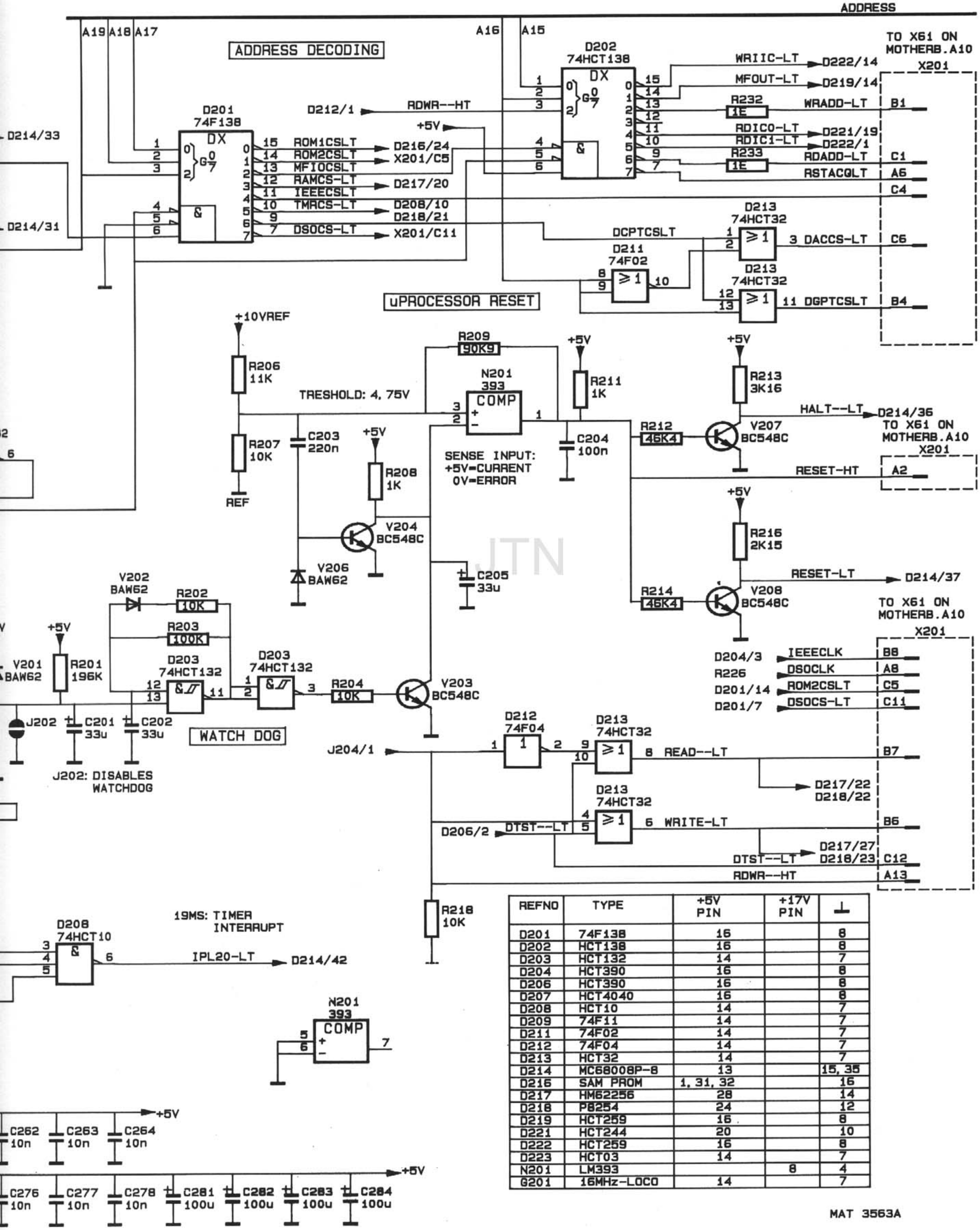
Signal name	Description	Signal source	Signal destination(s)
SCL0	Serial clock 0	D221	D223 - N102 - D7001 - D7002
SCL1	Serial clock 1	D223	D221 - D412
SDA	Serial data	D222	D223
SDA0	Serial data 0	D221	D223 - N101 - D7001 - D7002
SDA1	Serial data 1	D223	D222 - D412
SEL0	Select 0	D222	D223
SEL1	Select 1	D222	D223
SWR---HT	Sweep ready	D403	D221
SWTB	Slow time base	D218	D412 - D801
SWTBCLK	Slow time base clock	D409	D218 - D411
TBSYNCHT	Time base synchronisation	D403	D218
TESTO-HT	Test out	D4103	D221
TMRCS-LT	Timer chip select	D201	D208 - D218
VERIICHT	Vertical IIC select	D219	D2601
VLPRADLT	Valid peripheral address	D212	D214
WRIIC-LT	Write IIC	D202	D222
WRITE-LT	Write	D213	D116 - D217 - D218
WTDG	Watchdog	D222	R200



REFNO	TYPE	+5V PIN	+17V PIN	⊥
D201	74F138	16		8
D202	HCT138	16		8
D203	HCT132	14		7
D204	HCT390	16		8
D206	HCT390	16		8
D207	HCT4040	16		8
D208	HCT10	14		7
D209	74F11	14		7
D211	74F02	14		7
D212	74F04	14		7
D213	HCT32	14		7
D214	MC68008P-8	13		15, 35
D216	SAM PROM	1, 31, 32		16
D217	HM62256	28		14
D218	P8254	24		12
D219	HCT259	16		8
D221	HCT244	20		10
D222	HCT259	16		8
D223	HCT03	14		7
N201	LM393		8	4
G201	16MHz-LOCO	14		7

Figure 13.3 Circuit diagram of CPU unit: part 1


DTACK GENERATOR
D209 74F11
D212 74F04
D211 74F02
D204 74HCT390
D208 74HCT10
D203 74HCT132
D206 74HCT390
D207 74HCT4040
VLPRADLT
IACK--LT
DTACK-LT
ADST--LT
CPUCLK
IEEECLK
DSOACKLT
DCPTCSLT
TMRCS-LT
IEEECSLT
LOCOSC
DTST--LT
8MHz
32kHz
FROM X61 ON MOTHERB.A10
X201
CLOCK GENERATOR
G201 16MHz
R226 51E1
DSOCLK
20mS INTERRUPT
WTDG--HT
R200 10K
V200 BC548C
V201 BAW62
R201 196K
J202: DISABLES WATCHDOG
C201 33u
C202 33u
V202 BAW62
RSNT--HT
RESET-HT
V213 BAW62
V214 BAW62
R220 2K15
+10VREF
REF
+17VA
R251 10E
+17V
C251 10n
+5D
L251 15uH
C279 100n
C252 220u
+5V

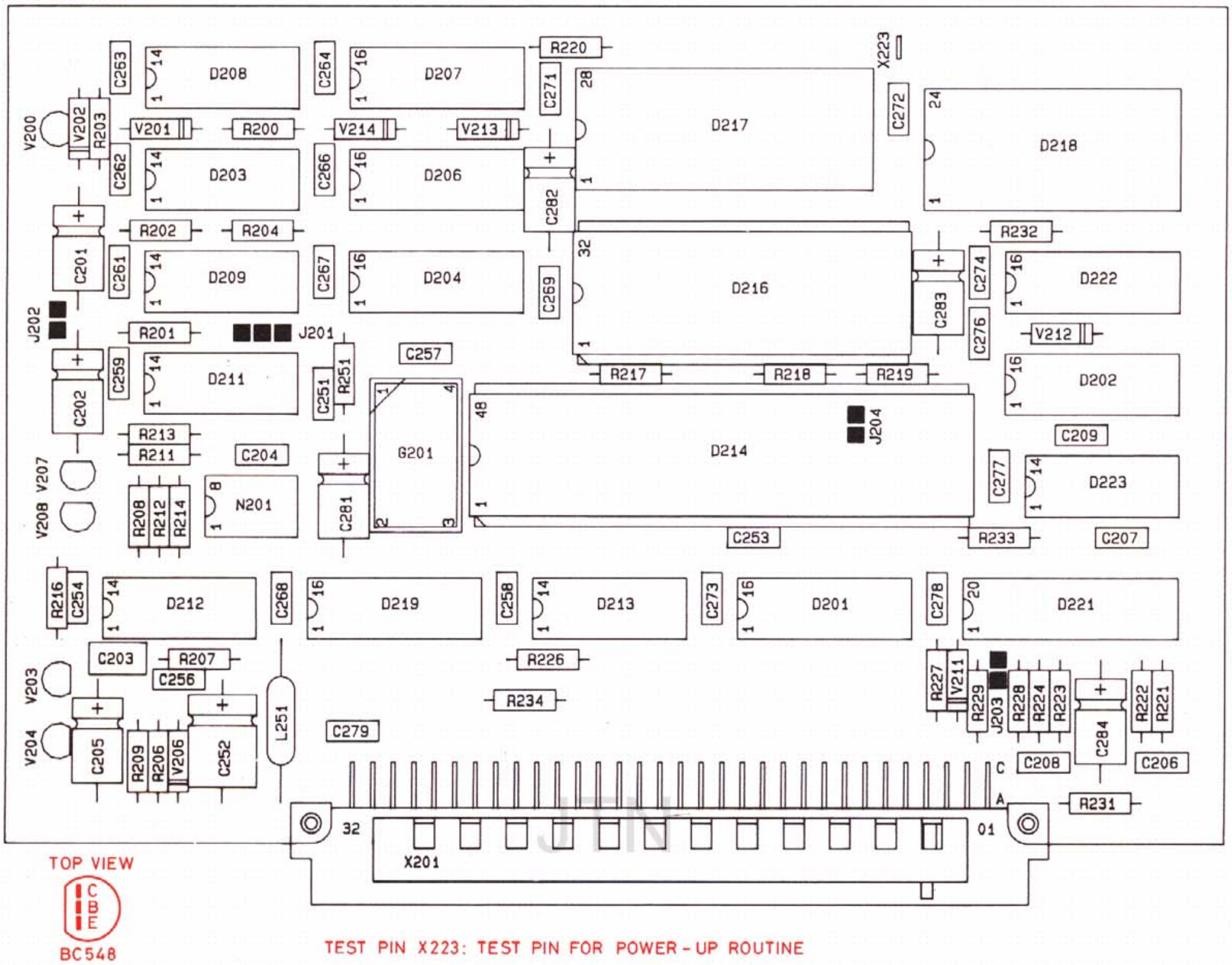


REFNO	TYPE	+5V PIN	+17V PIN	⊥
D201	74F138	16		8
D202	HCT138	16		8
D203	HCT132	14		7
D204	HCT390	16		8
D206	HCT390	16		8
D207	HCT4040	16		8
D208	HCT10	14		7
D209	74F11	14		7
D211	74F02	14		7
D212	74F04	14		7
D213	HCT32	14		7
D214	MC68008P-8	13		15, 35
D216	SAM PROM	1, 31, 32		16
D217	HM62256	28		14
D218	P8254	24		12
D219	HCT259	16		8
D221	HCT244	20		10
D222	HCT259	16		8
D223	HCT03	14		7
N201	LM393		8	4
G201	16MHz-LOCO	14		7

MAT 3563A

Figure 13.3 Circuit diagram of CPU unit: part 1

A12



TEST PIN X223: TEST PIN FOR POWER-UP ROUTINE

SOLDERJOINTS :

J201	IF CLOSED, UNIT A12 CAN FUNCTION STAND ALONE
J202	IF CLOSED, SWITCHES-OFF THE WATCHDOG
J203	IF CLOSED, RAM TEST IS NOT EXECUTED IN POWER-UP ROUTINE
J204	NOT USED

Figure 13.4 CPU unit p.c.b.

MAT3565A

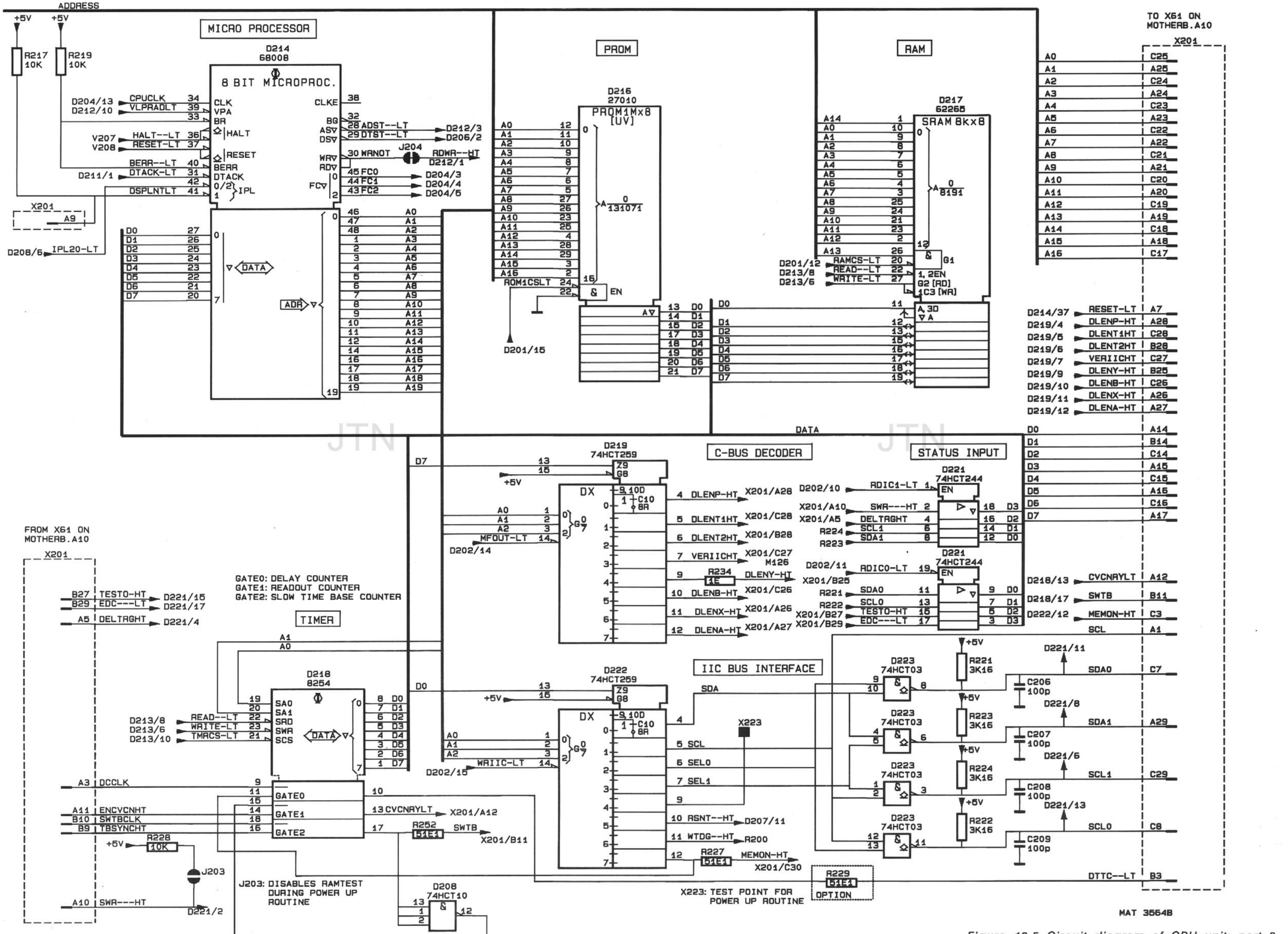
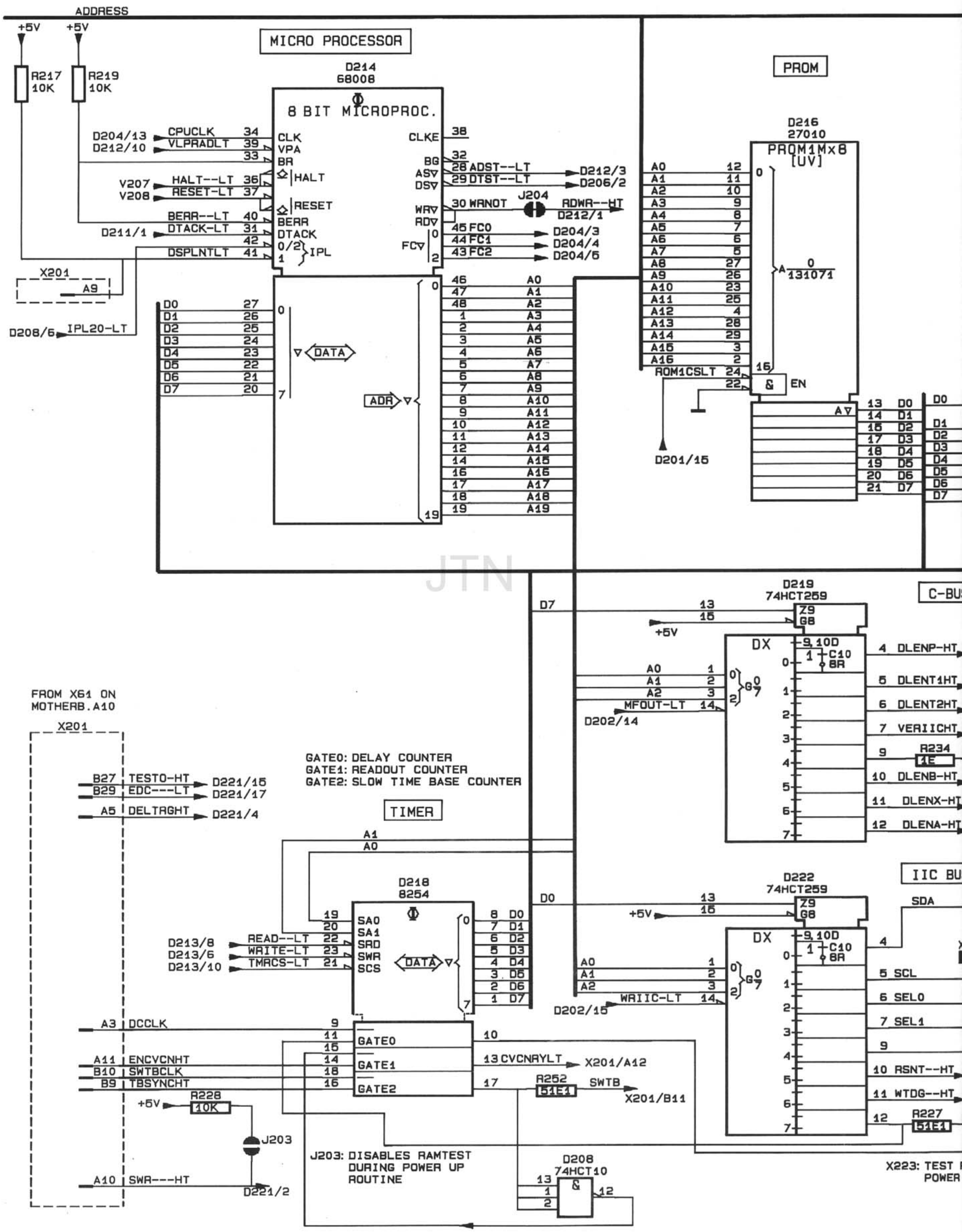


Figure 13.5 Circuit diagram of CPU unit: part 2


ADDRESS
MICRO PROCESSOR
D214
68008
8 BIT MICROPROC.
R217 10K
R219 10K
+5V
CPUCLK
VLPRADLT
HALT--LT
RESET-LT
BERR--LT
DTACK-LT
DSPLNTLT
IPL20-LT
D204/13
D212/10
V207
V208
D211/1
D208/6
X201
A9
CLK
VPA
BR
HALT
RESET
BERR
DTACK
IPL
CLKE
BG
AS
DS
WR
RD
FC
ADST--LT
DTST--LT
WRNOT
J204
RDWR--HT
D212/3
D206/2
D212/1
FC0
FC1
FC2
D204/3
D204/4
D204/5
DATA
ADR
PROM
D216
27010
PROM1Mx8
[UV]
131071
ROM1CSLT
EN
D201/15
C-BUS
D219
74HCT259
D222
74HCT259
DX
MFOUT-LT
D202/14
DLENP-HT
DLENT1HT
DLENT2HT
VERIICHT
R234
DLENB-HT
DLENX-HT
DLENA-HT
IIC BUS
SDA
SCL
SEL0
SEL1
RSNT--HT
WTDG--HT
R227
51E1
WRIIC-LT
D202/15
FROM X61 ON
MOTHERB.A10
TESTO-HT
EDC---LT
DELTRGHT
D221/15
D221/17
D221/4
GATE0: DELAY COUNTER
GATE1: READOUT COUNTER
GATE2: SLOW TIME BASE COUNTER
TIMER
D218
8254
SA0
SA1
SRD
SWR
SCS
READ--LT
WRITE-LT
TMRCS-LT
D213/8
D213/6
D213/10
DCCLK
ENCVCNHT
SWTBCLK
TBSYNCHT
GATE0
GATE1
GATE2
CVCNRYLT
X201/A12
R252
51E1
SWTB
X201/B11
R228
10K
J203
SWR---HT
D221/2
J203: DISABLES RAMTEST
DURING POWER UP
ROUTINE
D208
74HCT10
X223: TEST
POWER

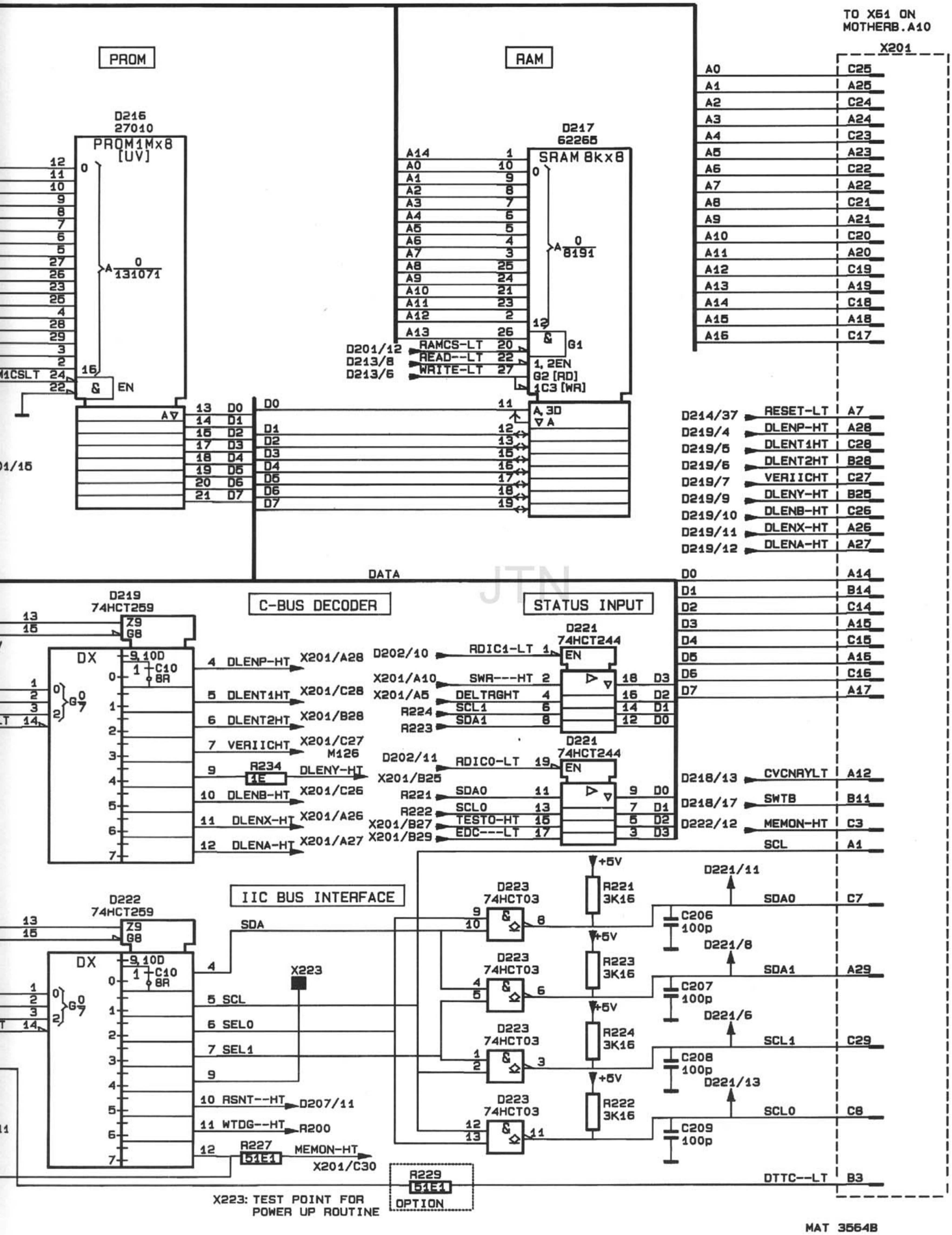


Figure 13.5 Circuit diagram of CPU unit: part 2

14 DCL UNIT (A13)

The DCL (Display ControL) unit consists of:

- acquisition memory with associated components
- display memory with associated components
- control array
- dots + plotter control

14.1 ORGANISATION OF THE MEMORY

The memory consists of a 8k x 8 static RAM (Random Access Memory) D308, and a 32k x 8 static RAM D304.
D308 is called the acquisition memory.

D304 is called the display memory. This device is divided into:
- 4k byte trace memory
- 4k register back-up memory
- 4k text memory

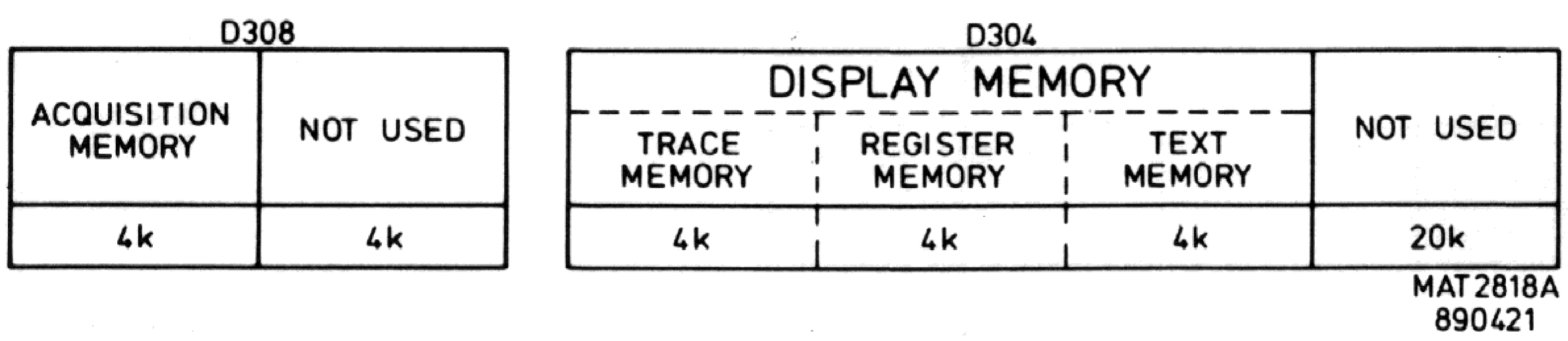


Figure 14.1 Organisation of the memory

Notice that the display memory is provided with a battery back-up circuit. When the instrument is switched off, the RAM D304 keeps its supply voltage Vbb by means of an analog OR-gate V301-V302.

Addressing of the memories is achieved by two counters, COUNTER 1 (D309) and COUNTER 2 (D306), or by the microprocessor. Both counters are divided in three similar 12-bit counters selected by the OS0-pin 32 and OS1-pin 31 inputs. The TC output pin 9 detects an overflow of a counter. These signals are applied to the control array D314.

14.2 INTRODUCTION TO THE SAMPLE TRANSPORTS

The digital processor unit must generate the timing signals for the following sample-transports:

- Transport of signal samples from the ADC unit A15 to the acquisition memory.
- Transport of signal samples from the acquisition memory to the display (trace) memory.
- Transport of signal samples from the display (trace) memory to the CRT screen.
- Reading/writing of signal samples by the microprocessor from/to the display memory.

As well as the counters, the microprocessor is connected to the address bus ZA0 ...14. The microprocessor is buffered with a 14-bit tri-state buffer D301 and D302. The counters have access to the address bus sequentially. If a counter requires access to the address bus, this occurs in a certain time interval of 500 ns and is controlled by the signals SC0...SC4. SC2 and SC3 are inside the control array D314 and are not visible.

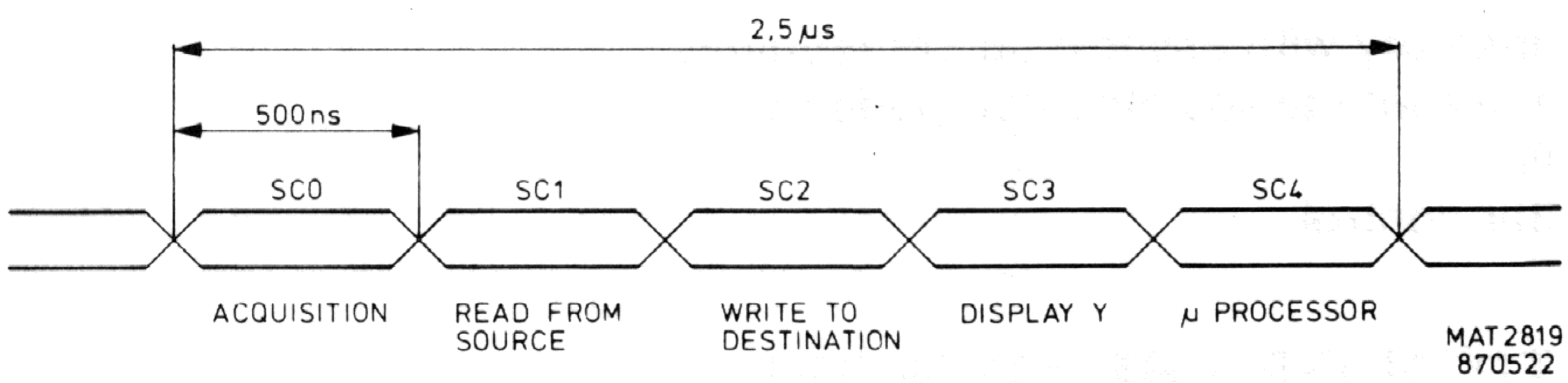


Figure 14.2 Display cycle controlled by SC0...4

The different sample transports are described separately in the next sections.

14.3 SIGNAL ACQUISITION

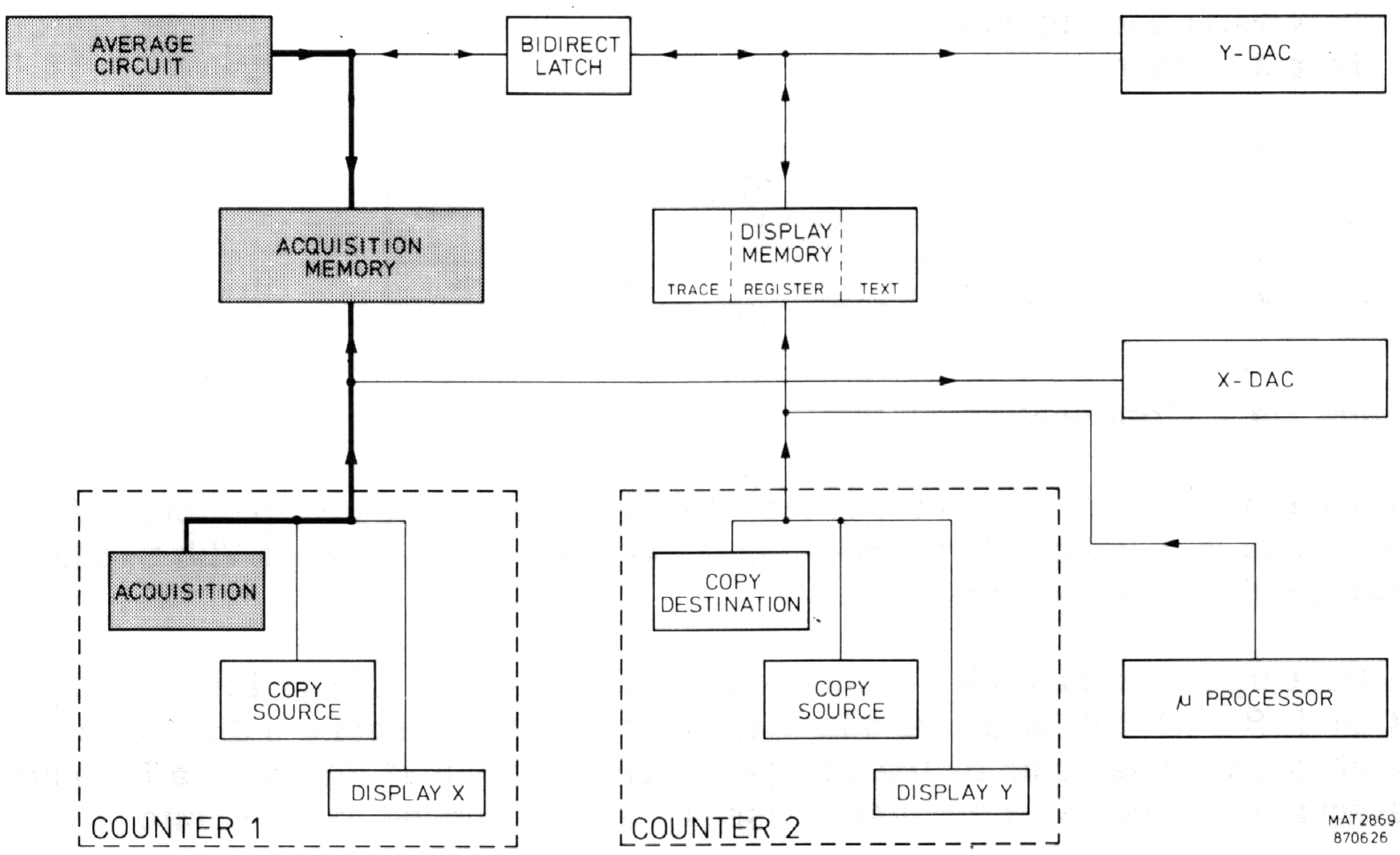


Figure 14.3 Block diagram of signal acquisition

The three blocks inside the dotted blocks (marked "counter 1" and "counter 2") indicate the three possible modes the counter can operate in.
During SC0 and if WRSMP is high the samples are taken from the average circuit on unit A14. These samples are put on the data bus PD0 ...7 and written in the acquisition memory D308. The addressing is obtained by the acquisition counter D309.

14.4 COPYING SAMPLES TO DISPLAY MEMORY

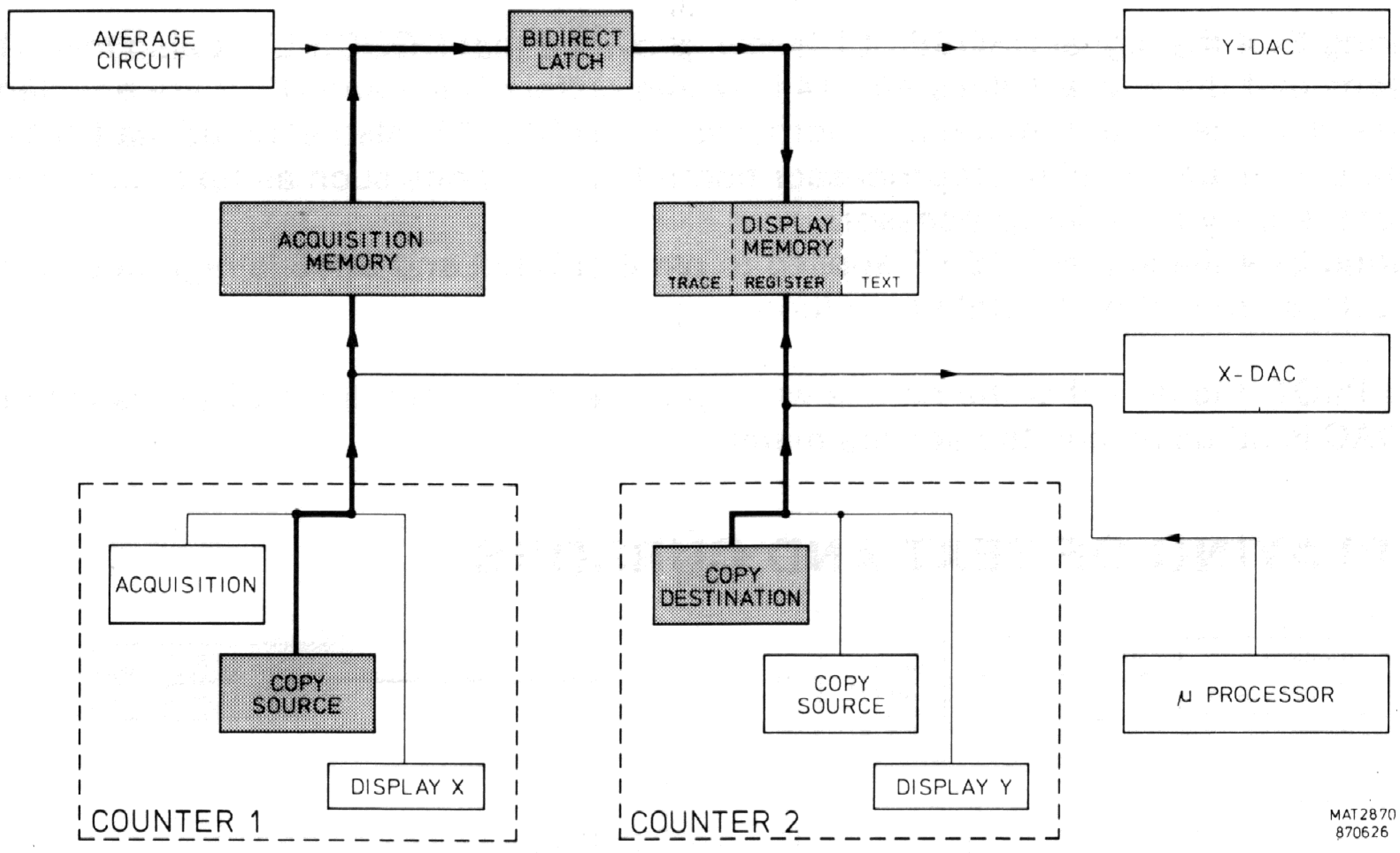


Figure 14.4 Block diagram of copying samples to display memory

During SC1 the data from the acquisition memory is read by counter 1 D309 and is written into the bidirectional latch of D314.
Then during SC2 the copy destination counter of D306 reads the data from the latch and writes this data into the display memory D304.

14.5 DISPLAYING OF TRACE AND REGISTER

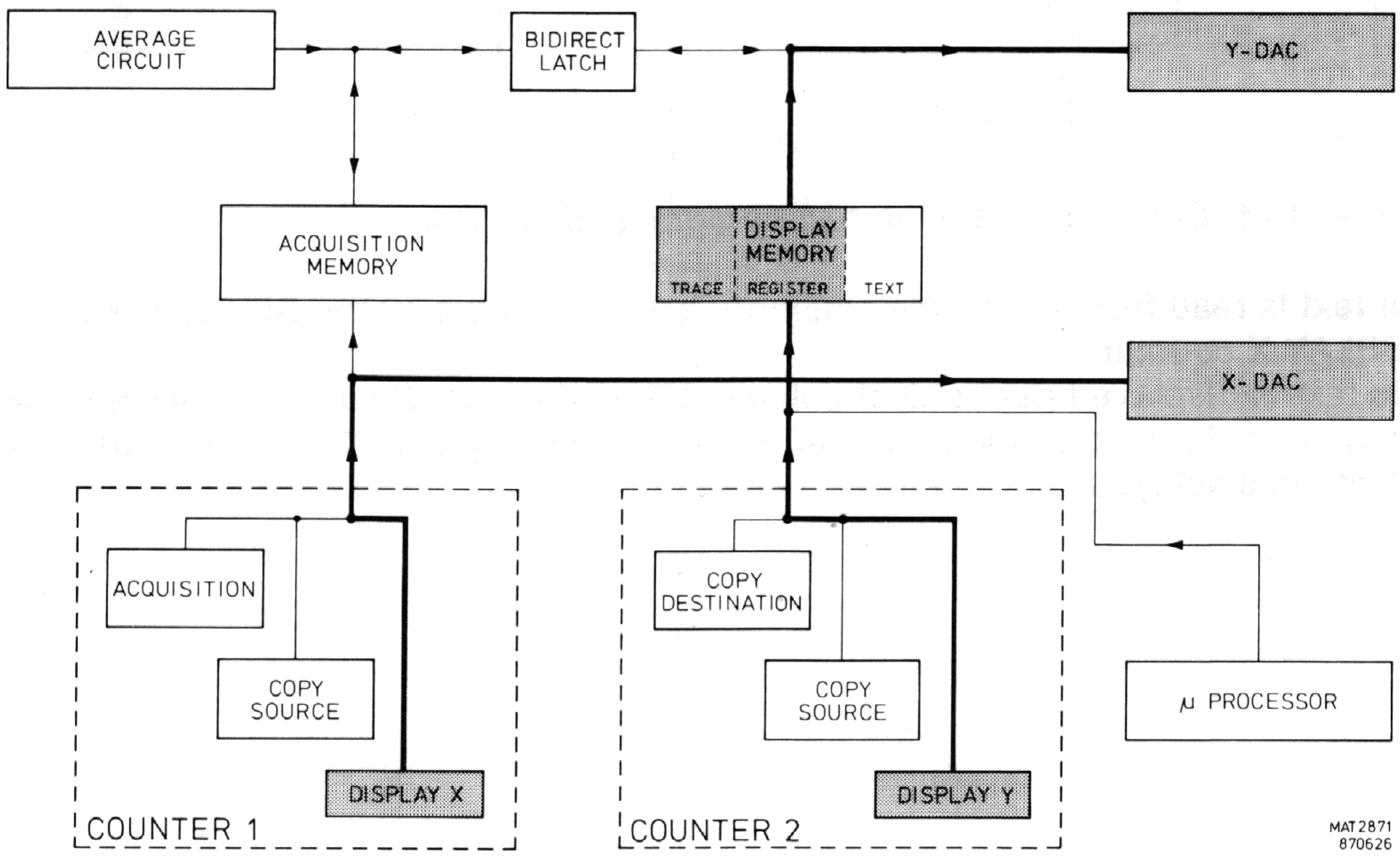


Figure 14.5 Block diagram of trace/register display flow

During SC3, the data from the display memory D304 is read by display counter D306 and is written to the Y-DAC latch D413 on unit A14. The X address is determined by counter D309 and is latched in D311 and D312. These addresses are clocked by the signal XYDLE generated by D314.

14.6 MICROPROCESSOR MANIPULATION

During SC4 the signal DSOSEL-LT is low, provided that DCOCS-LT is also low. This means that the address lines A0...14 from the buffers D301 and D302 are enabled. At the same time the data from the microprocessor bus D0...7 is also enabled via D303. This data can influence all microprocessor controlled functions such as text, plot, dots, also addressed by the microprocessor.
During SC4 the signal TOE-LT applied to pin 8 of D309 and D306 is high because both counters are in their tri-state condition.

For PLOT, the time that the data is written to the Y-DAC and the address is written to the X-DAC is adjustable in the service menu.

14.7 DISPLAYING OF TEXT AND CURSORS

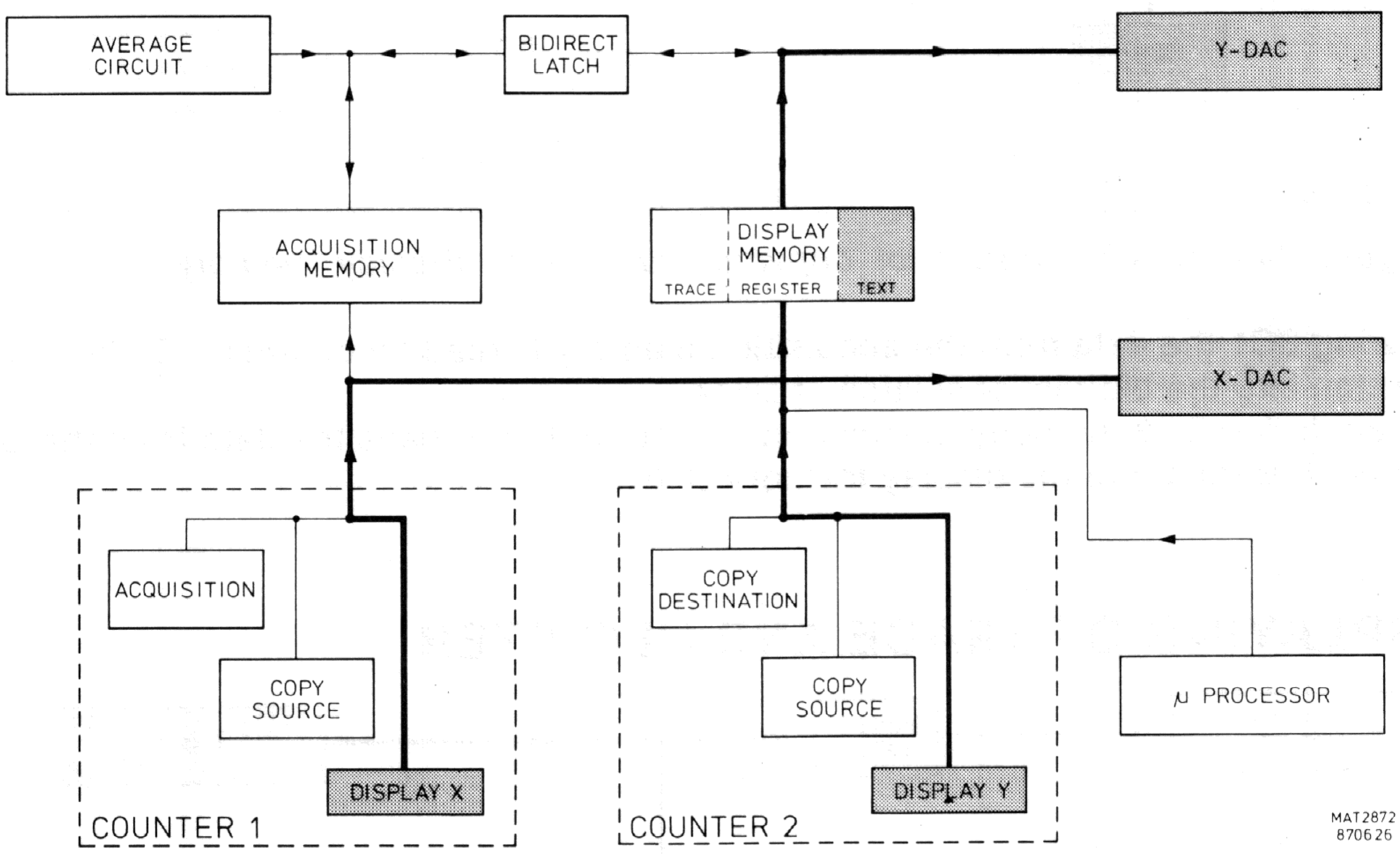


Figure 14.6 Block diagram of text/cursors display flow

The text is read from the display memory and addressed by the DISPLAY Y counter and DISPLAY X counter.
This text is displayed per vertical column. When the Y-DAC data has reached the control character $FF, the display X counter receives a clock-pulse. This means that the next column is displayed.

14.8 CLEARING THE DISPLAY MEMORY

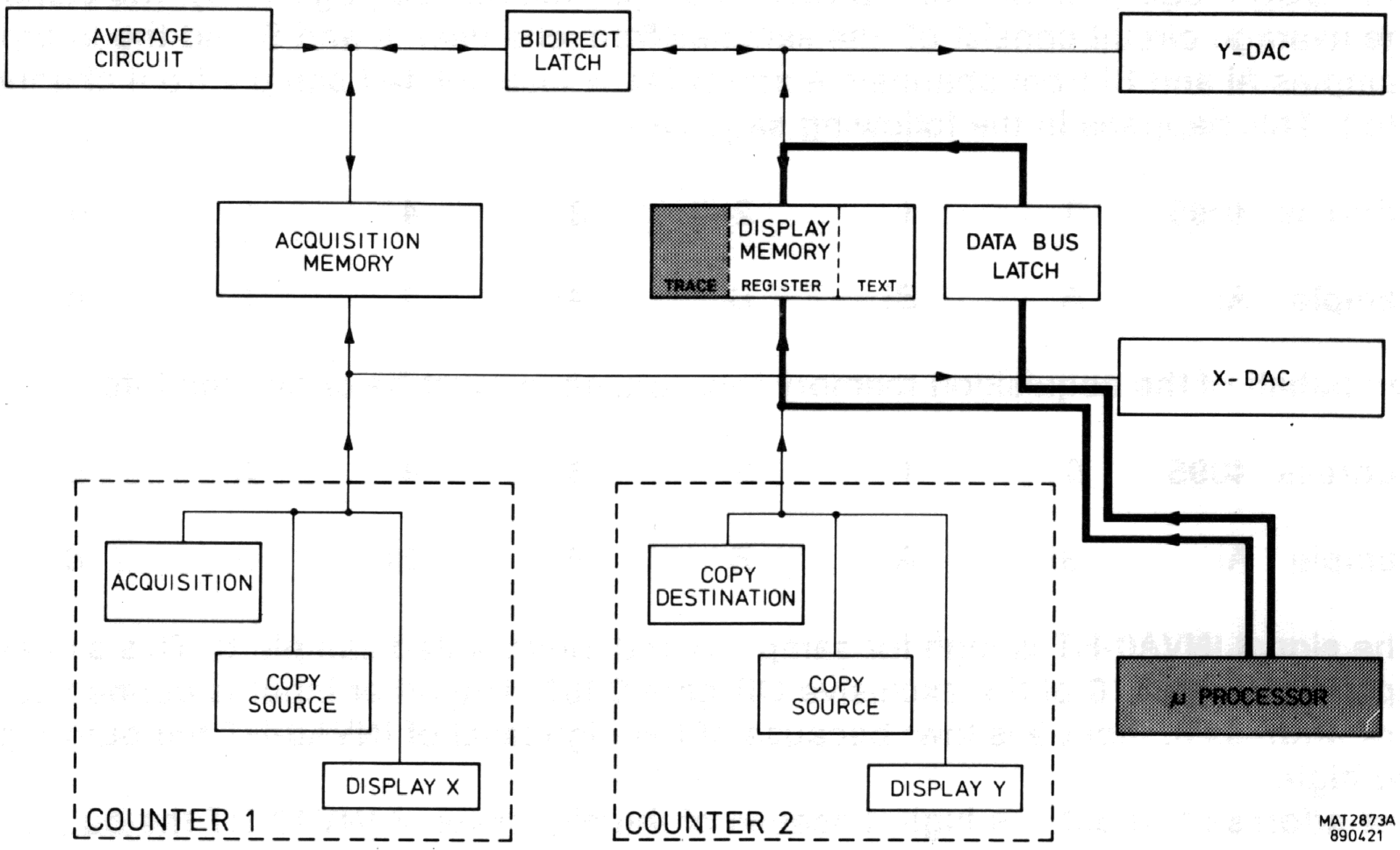


Figure 14.7 Block diagram of the clear function

When the clear function is active by means of the microprocessor, the display memory is written with $80 ($00) by the C.P.U. This means that the complete trace is cleared.

14.9 CLEARING THE ACQUISITION MEMORY

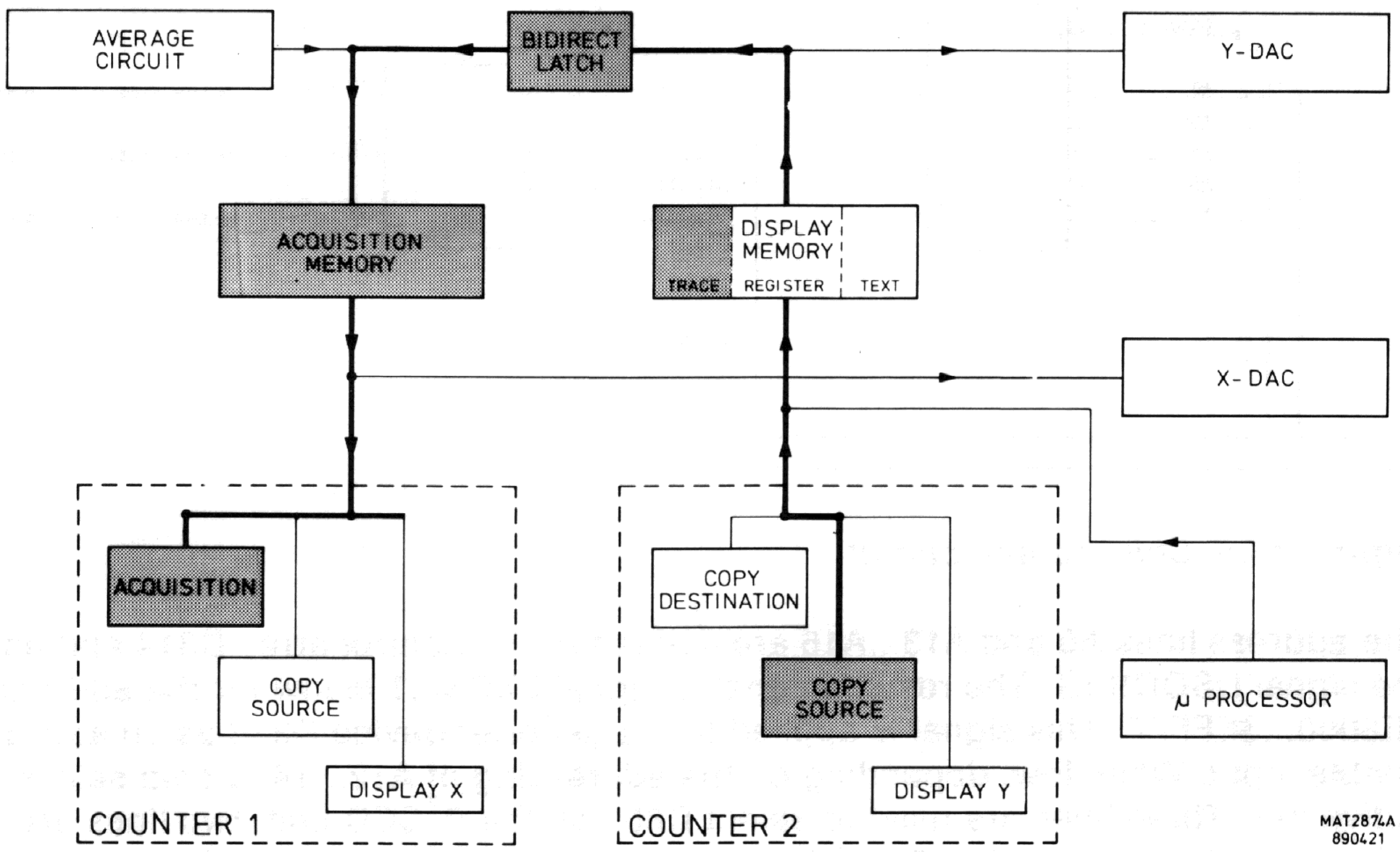


Figure 14.8 Block-diagram of the clear function

After the microprocessor has cleared the display memory, these samples are written into the bidirectional latch by means of the copy source counter of D306. Then the acquisition counter of D309 writes these samples from the latch into the acquisition memory.

14.10 EXOR D307

In P²CCD mode (P mode) and Direct mode (D1 mode, see page 18-4), the samples from the average circuit consist of the samples from channels A and B and the interpolated samples Ai and Bi from channels A and B (Ai = interpolated sample from channel A, etc.). This happens in the following sequence:

address	4095	0	1	2	3	4	5	6
sample	Ai	A	Bi	B	Ai	A	Bi	A

On behalf of the acquisition memory this sequence must be converted into:

address	4095	0	1	2	3	4	5	6
sample	Ai	Bi	A	B	Ai	Bi	A	B

The signal INVA0-HT is high for sample A and interpolated sample B. This signal is applied to input 10 of the exclusive OR-gate D307. The other input is connected to PA0.
For address 0, input 9 is low; because of the high level of INVA0-HT the output pin 8 will be high.
For address 1, input 9 is high; because of the high level of INVA0-HT the output pin 8 will be low, etc.
Thus inverting of address line PA0 during sample A and interpolated sample B is obtained.

14.11 CHIP SELECT

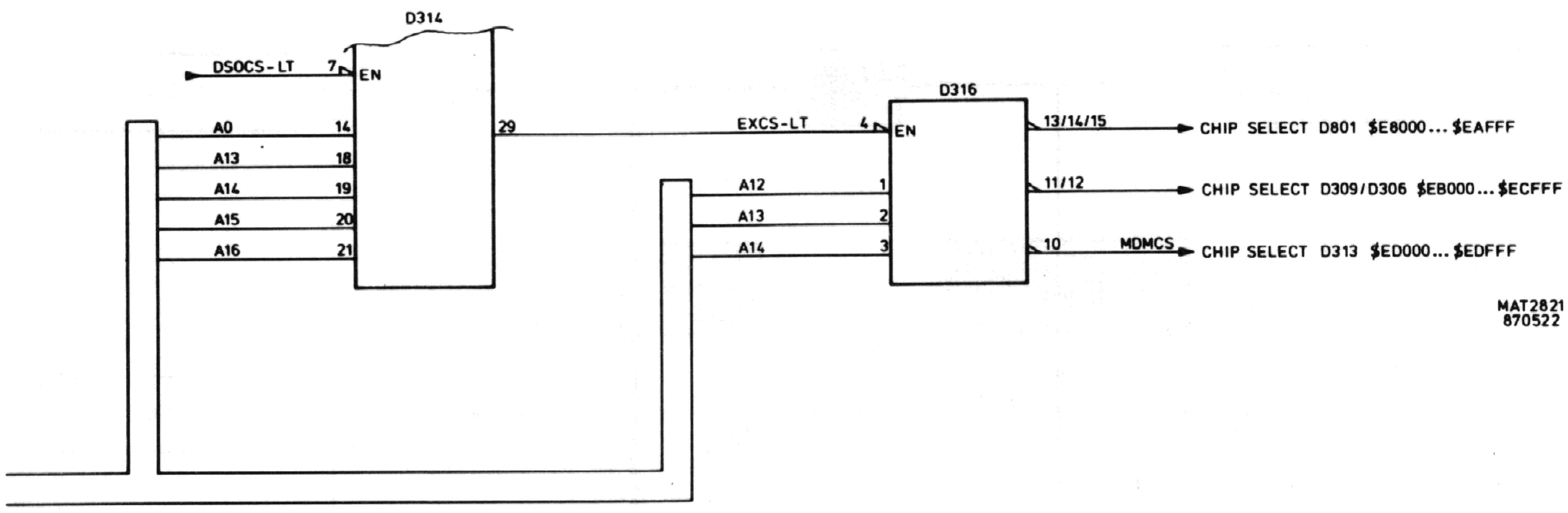


Figure 14.9 Chip select circuit

The address lines A0 and A13...A16 are applied to the control array D314 and enabled by the signal DSOCS-LT. The resulting enable signal EXCS-LT is low for the addresses $E8000...$EFFFF. This signal is applied to the decoder device D316 as an active low enable input. When low, depending on the addressing of A12...14, a chip select output is active low. Three lines are used to select D801 on the P²CCD unit, two lines are used to select the two counters D306 or D309 and one line is used to select D313.

14.12 DOTS AND PLOTTER CONTROL

Addressed by BA0...BA2 which are simultaneously with A0...A2 the data on PD0 is applied to one of six output lines. These static lines DOTS-LT, PLOT-HT, PENLIFT, POSXOF-HT, TRIGEN-HT and OSCON-LT control several functions in the instrument such as among other things, the DOTS and plotter.

14.13 TIMING DIAGRAM

The following figure gives the timing diagram for the gate array D314 for the display cycle.

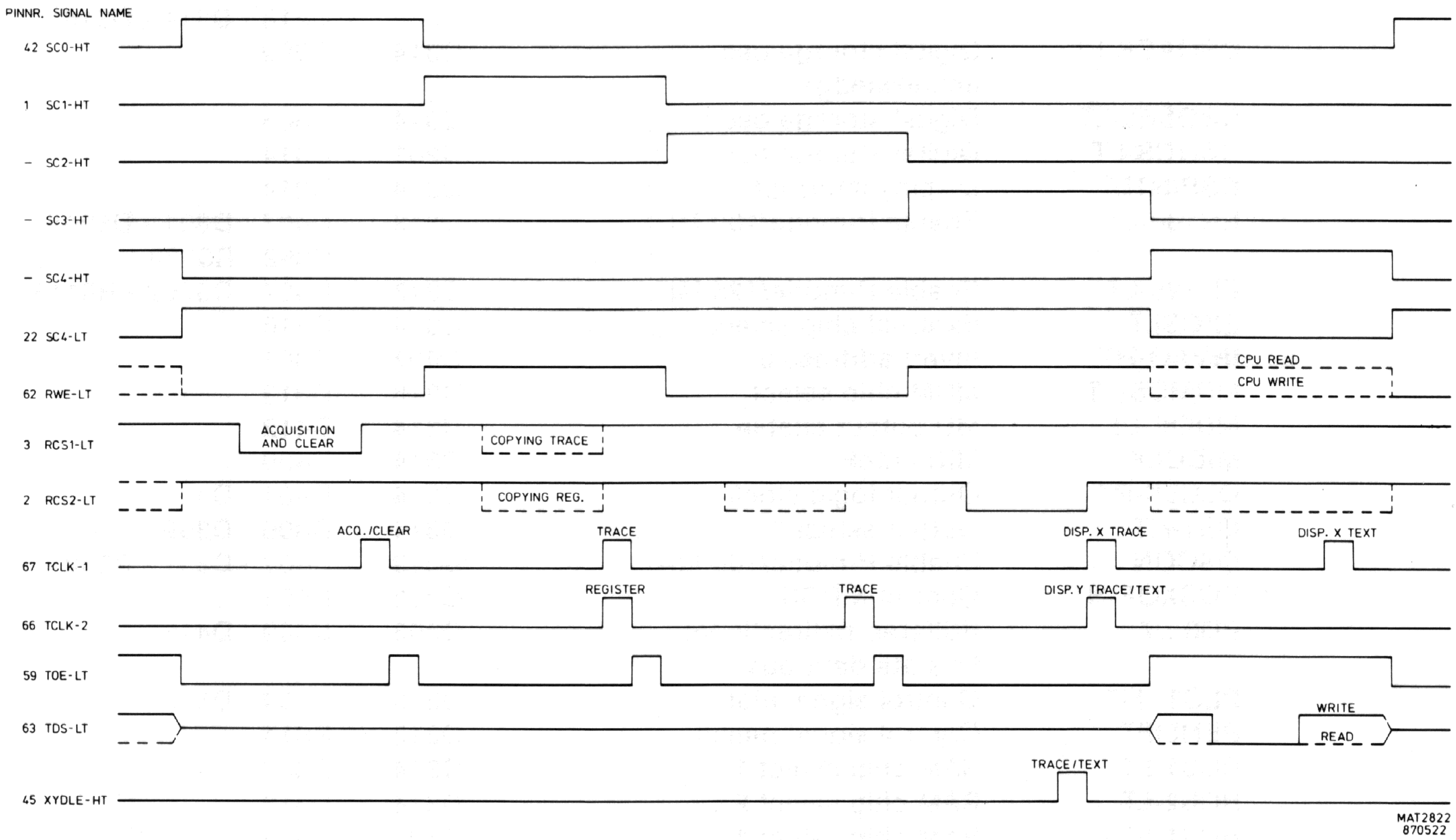


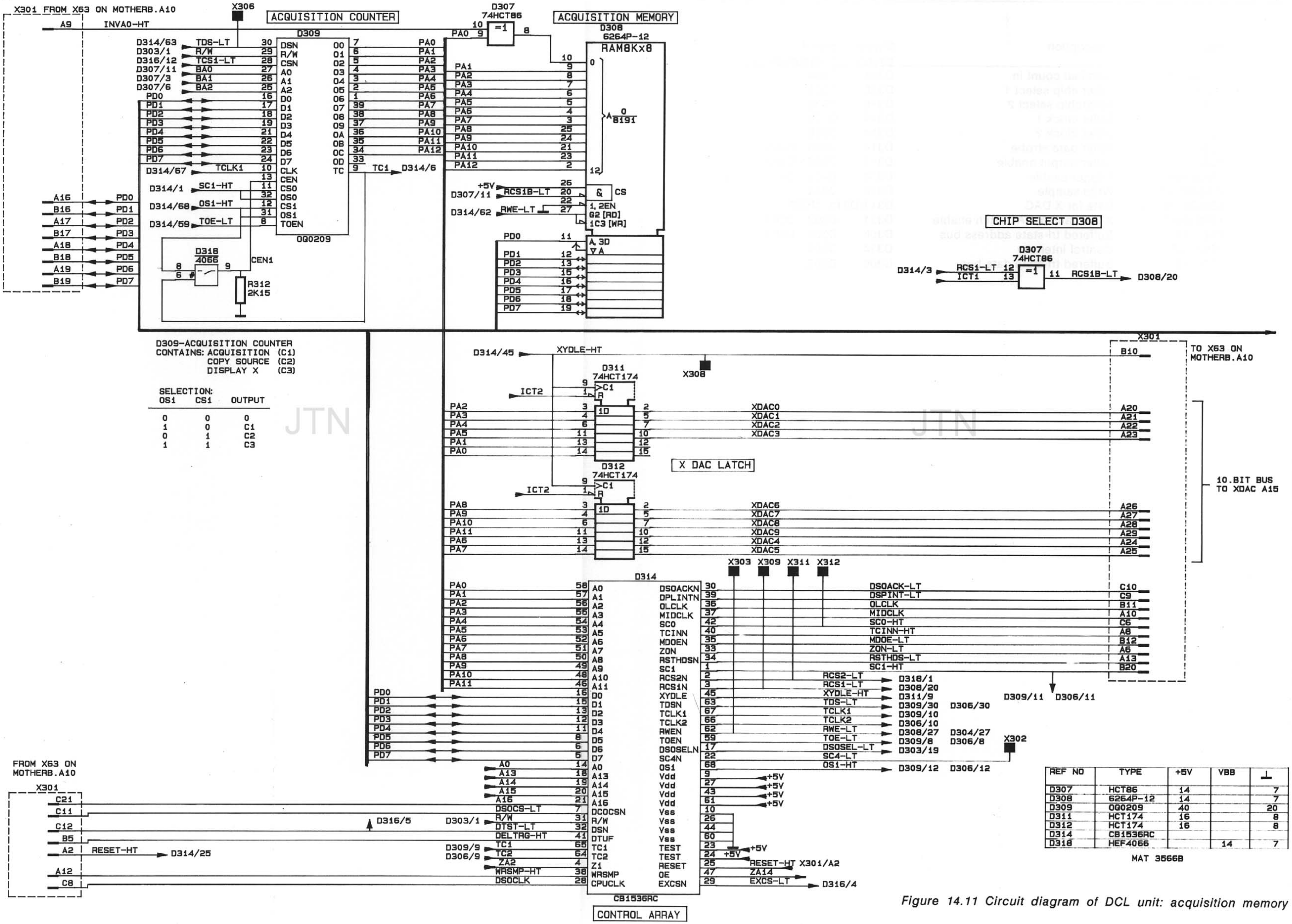
Figure 14.10 Timing diagram for D314

14.14 SIGNAL NAME LIST

Signal name	Description	Signal source	Signal destination(s)
A0...16	Address bus	D214	D216 - D217 - D301 - D303
BA0...2	Buffered address bus	D318	D306 - D307 - D313
D0...D7	Data bus	D216	D116 - D214 - D217 - D303
DATEN-HT	Data enable	D313	D416
DCWE--HT	Delay counter write	D316	D801
DLTRG-HT	Delay trigger	D402	D314 - D406
DOTS--LT	Control signal for dot join	D313	D503 - D505
DTST-LT	Data strobe	D214	D201 - D202 - D206 D213 - D314 - D316
DSOACK-LT	Digital storage osc. acknowledge	D314	D209
DSOSEL-LT	Digital storage osc.	D314	D303
DSOCS-LT	Digital storage osc.	D201	D314
DSPINTLT	Display interrupt	D314	D214
EN100-LT	Enable P-mode/100 MHz	D313	D407 - D801 - D5205 - R862 - R5128
EN125-LT	Enable P-mode/125 MHz	D313	D407 - D5202 - R5113
EXCSLT	External chip select	D314	D316
INVAO-HT	Invert address 0	D407	D307
MDMCS-LT	MDM chip select	D316	D313
MDOE-LT	MD output enable	D314	D412
MIDCLK	MID clock	D314	D409
OLCLK-PT	Output logic clock	D314	D401 - D409
OS1-HT	Output select 1	D314	D306 - D309
OSCON	Enable P-mode/100 MHz	D313	D407 - D801 - R862
POSXOF-HT	Control X POS	D313	R555
PD0...7	Buffered bidirectional tri-state data bus	D303	D309 - D413
PLOT--HT	Control signal plot	D313	D504 - D512
PENLIFT	Control signal penlift	D313	R614
RCS1-LT	RAM chip select 1	D314	D307
RCS2-LT	RAM chip select 2	D314	D318
RCS1B-LT	RAM chip select 1 buffered	D307	D308
RCS2B-LT	RAM chip select 2 buffered	D318	D304
RDWR-HT	Read/write	D214	D212 - D213
RESET-HT	Reset, high active	D318	D116 - R211 - R212 - R213 - D314
RESET-LT	Reset, low active	V208	R191 - D214 - D318
R/W	Read/ write	D303	D306 - D309 - D314
RWE-LT	RAM write	D314	D304 - D308
RSTHDS-LT		D314	D401
SC0--HT	State counter 0	D314	D407 - D408
SC1--HT	State counter 1	D314	D408
STWE-LT	Status write	D316	D801
TBWE-LT	Time base write	D316	D801
TC1	Terminal count 1	D309	D314
TC2	Terminal count 2	D306	D314

Note: *Signal OSCON-LT and EN100-LT, generated by D313/10 are identical.*

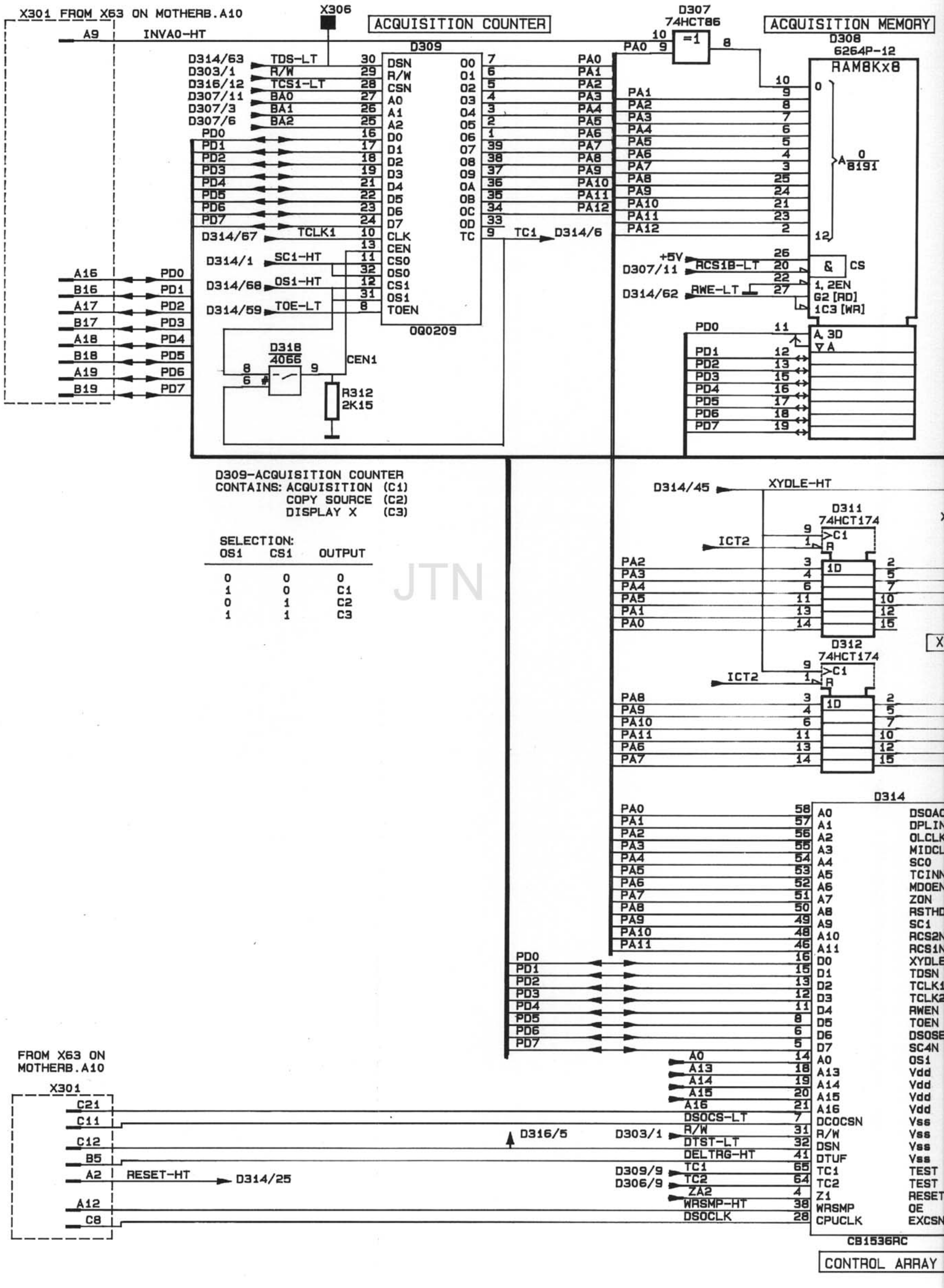
Signal name	Description	Signal source	Signal destinartion(s)
TCINN-PT	Terminal count in	D314	D404
TCS1-LT	Teller chip select 1	D316	D309
TCS2-LT	Tellerchip select 2	D316	D306
TCLK1	Teller clock 1	D314	D309
TCLK2	Teller clock 2	D314	D306
TDS-LT	Teller data strobe	D314	D306 - D309
TOE-LT	Teller output enable	D314	D306 - D309
TRIGENHT	Trigger enable	D313	D402 - D402 - D406
WRSMP-HT	Write sample	D412	D314
XDAC0...9	Data for X DAC	D311/D312	N507
XYDLE-HT	X DAC and Y DAC latch enable	D311	D302 - D304
ZA0...14	Buffered tri-state address bus	D306	D302 - D304
ZON---LT	Control intensity	D314	D504
PA0...12	Buffered tri-state data bus	D309	D308

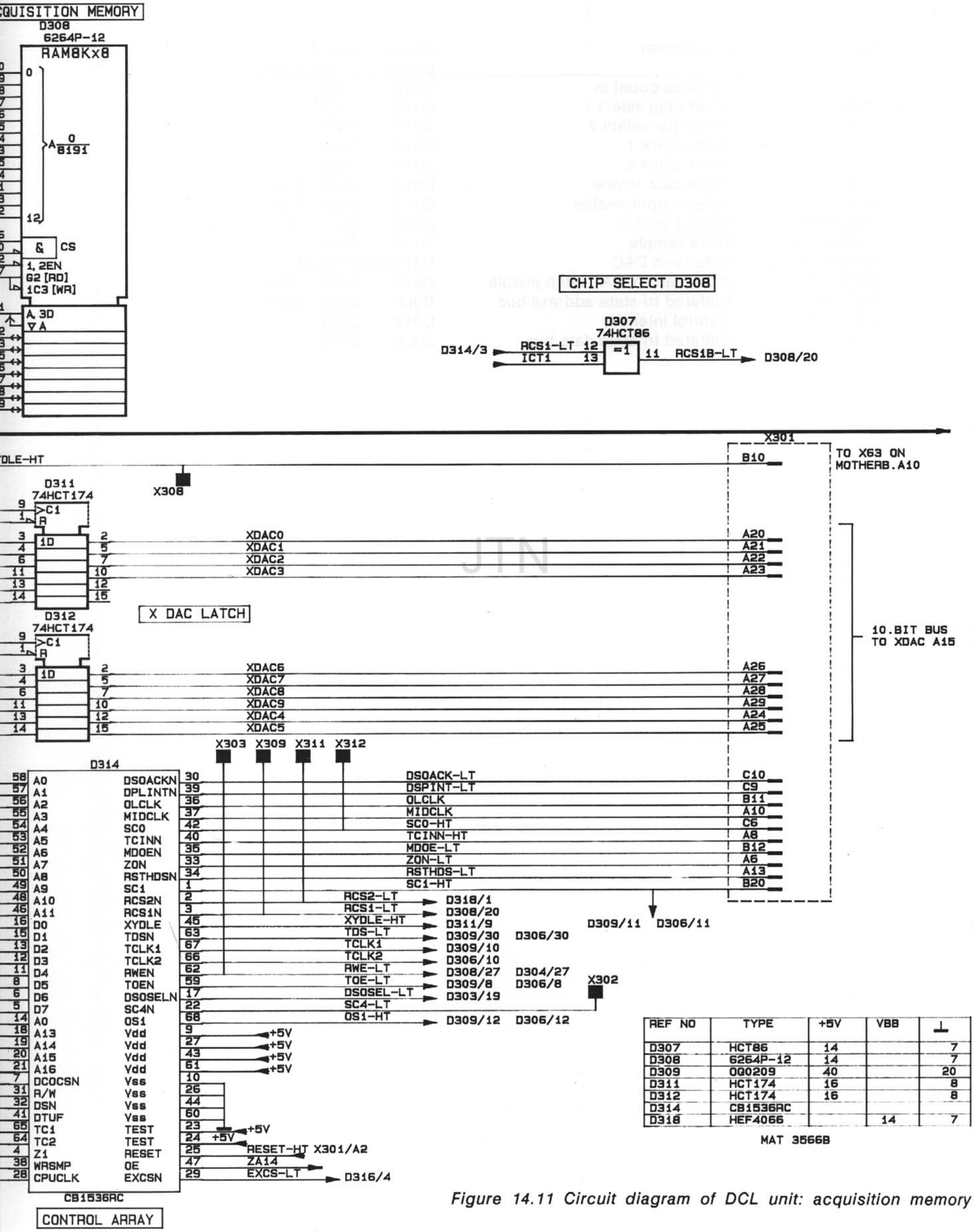


REF NO	TYPE	+5V	VBB	⊥
D307	HCT86	14		7
D308	6264P-12	14		7
D309	0Q0209	40		20
D311	HCT174	16		8
D312	HCT174	16		8
D314	CB1536RC			
D318	HEF4066		14	7

MAT 3566B

Figure 14.11 Circuit diagram of DCL unit: acquisition memory


X301 FROM X63 ON MOTHERB.A10
X306
ACQUISITION COUNTER
D307
74HCT86
ACQUISITION MEMORY
D308
6264P-12
RAM8Kx8
D309
0Q0209
A9 INVA0-HT
D314/63 TDS-LT
D303/1 R/W
D316/12 TCS1-LT
D307/11 BA0
D307/3 BA1
D307/6 BA2
DSN
R/W
CSN
A0
A1
A2
D0
D1
D2
D3
D4
D5
D6
D7
CLK
CEN
CS0
DS0
CS1
OS1
TOEN
D314/67 TCLK1
D314/1 SC1-HT
D314/68 OS1-HT
D314/59 TOE-LT
TC1 D314/6
D318
4066
CEN1
R312
2K15
+5V
D307/11 RCS1B-LT
D314/62 RWE-LT
1, 2EN
G2 [RD]
1C3 [WR]
A, 3D
D309-ACQUISITION COUNTER
CONTAINS: ACQUISITION (C1)
COPY SOURCE (C2)
DISPLAY X (C3)
SELECTION:
OS1 CS1 OUTPUT
0 0 0
1 0 C1
0 1 C2
1 1 C3
D314/45 XYDLE-HT
D311
74HCT174
ICT2
D312
74HCT174
D314
CB1536RC
CONTROL ARRAY
FROM X63 ON
MOTHERB.A10
X301
RESET-HT D314/25
D316/5
D303/1
DSOCS-LT
DTST-LT
DELTRG-HT
D309/9 TC1
D306/9 TC2
ZA2
WRSMP-HT
DSOCLK
DCOCSN
DSN
DTUF
WRSMP
CPUCLK

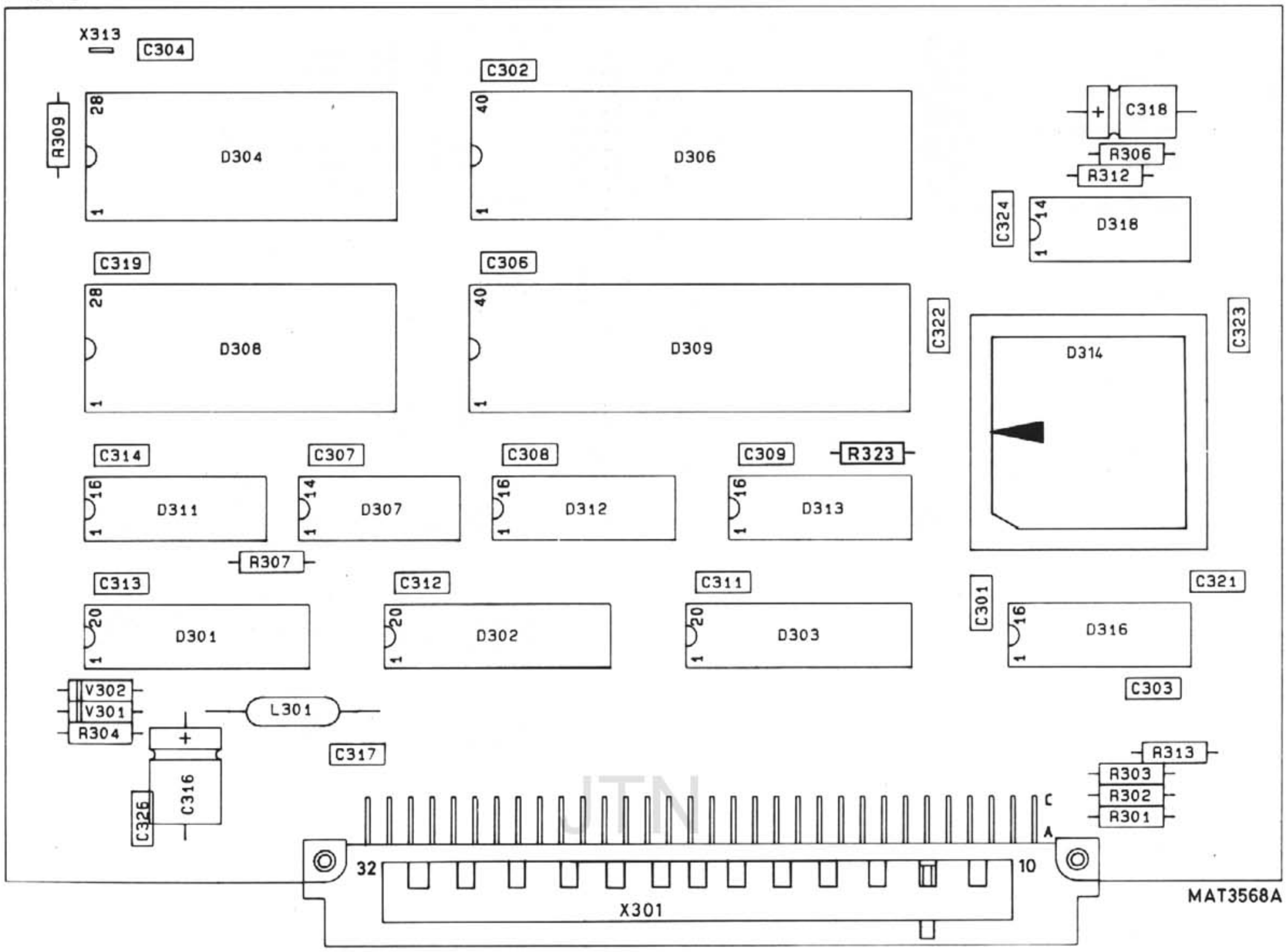


REF NO	TYPE	+5V	VBB	⊥
D307	HCT86	14		7
D308	6264P-12	14		7
D309	0Q0209	40		20
D311	HCT174	16		8
D312	HCT174	16		8
D314	CB1536RC			
D318	HEF4066		14	7

MAT 3566B

Figure 14.11 Circuit diagram of DCL unit: acquisition memory

A13



TEST PIN X313: BATTERY BACK-UP VOLTAGE V_{CC}

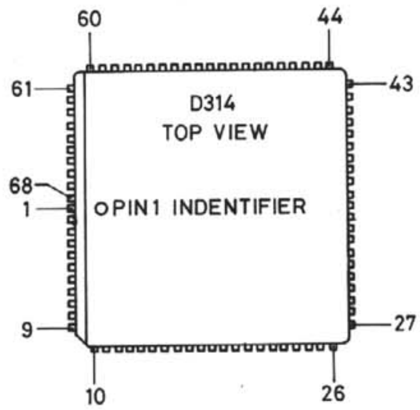
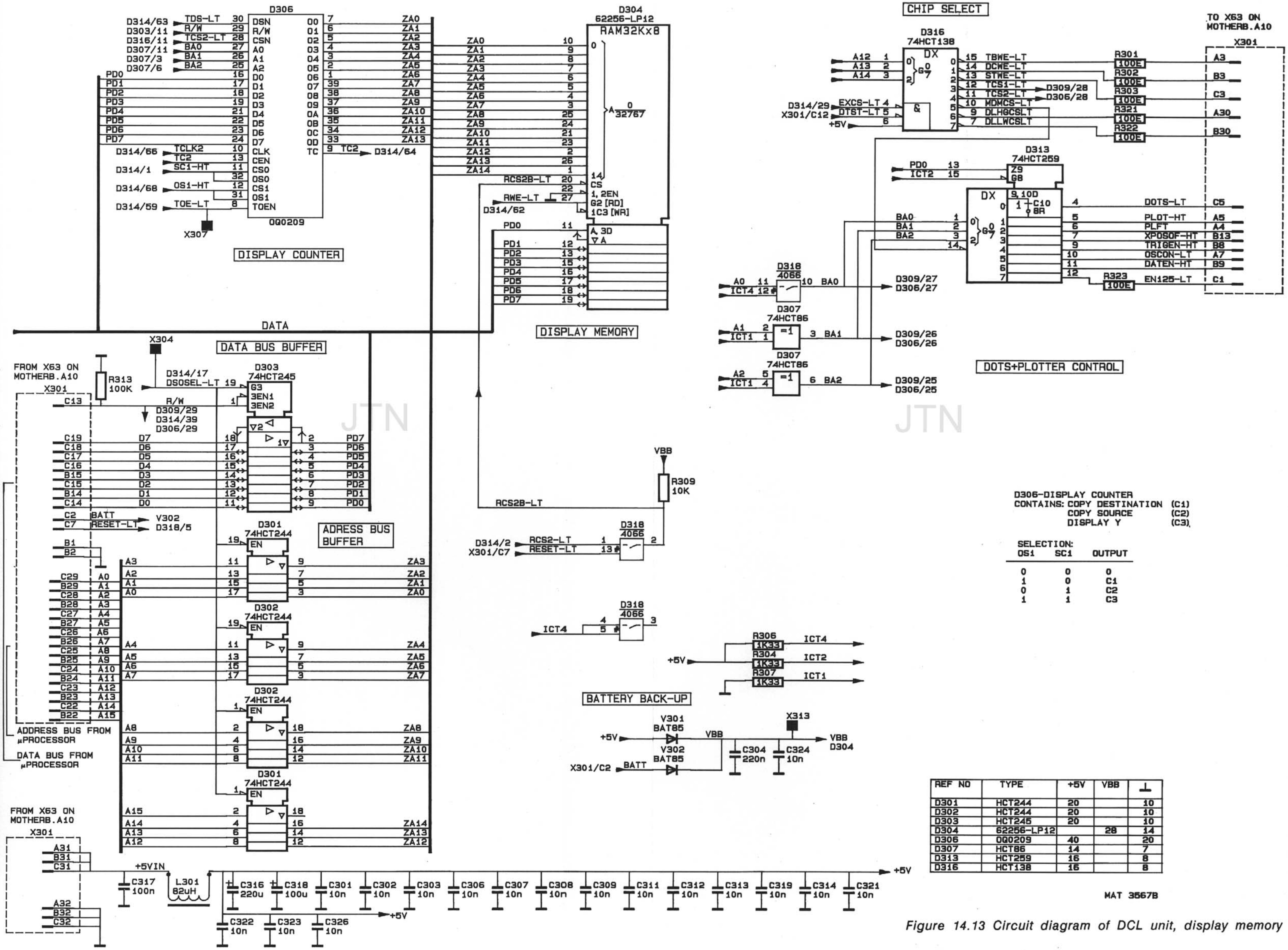


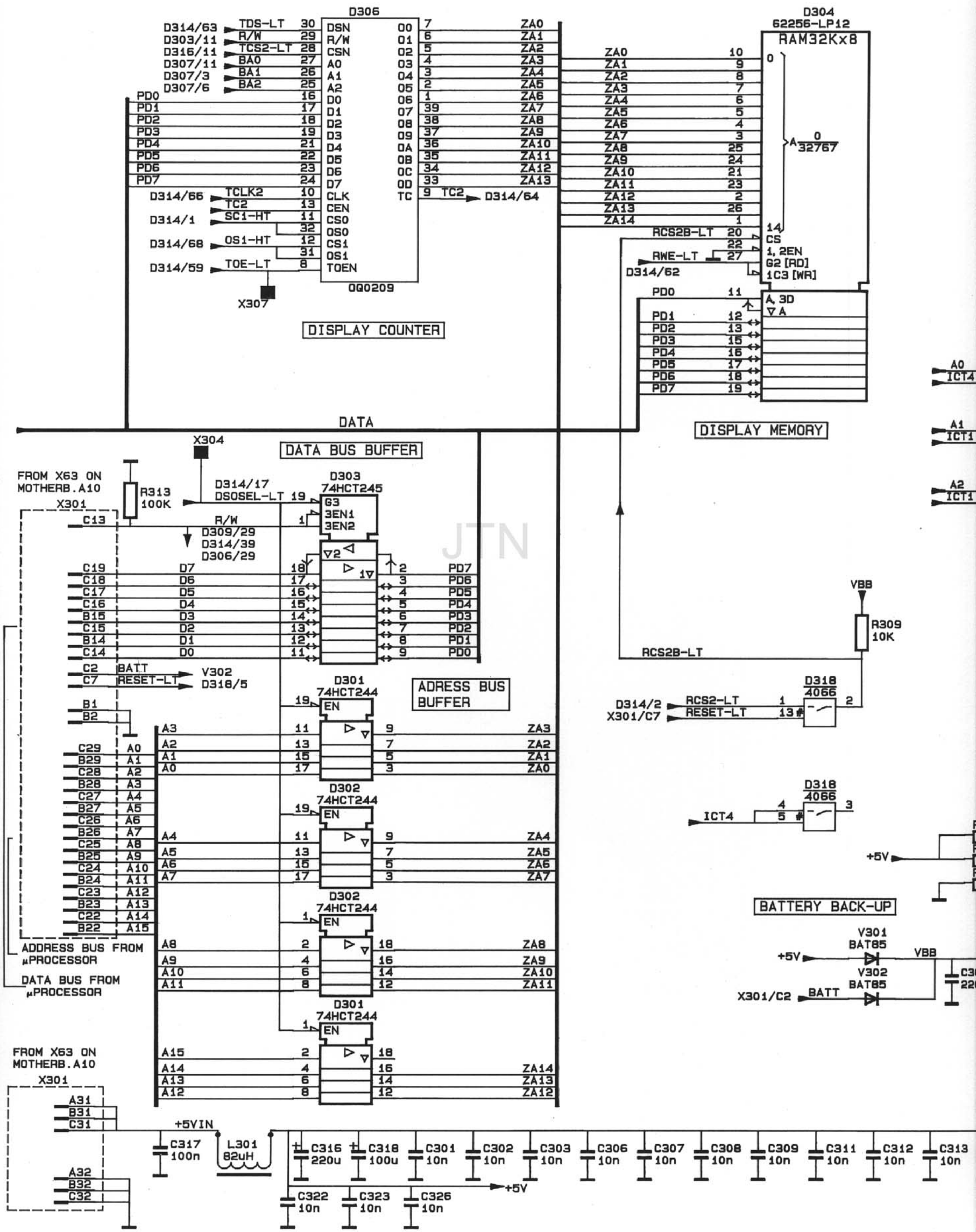
Figure 14.12 DCL unit p.c.b.



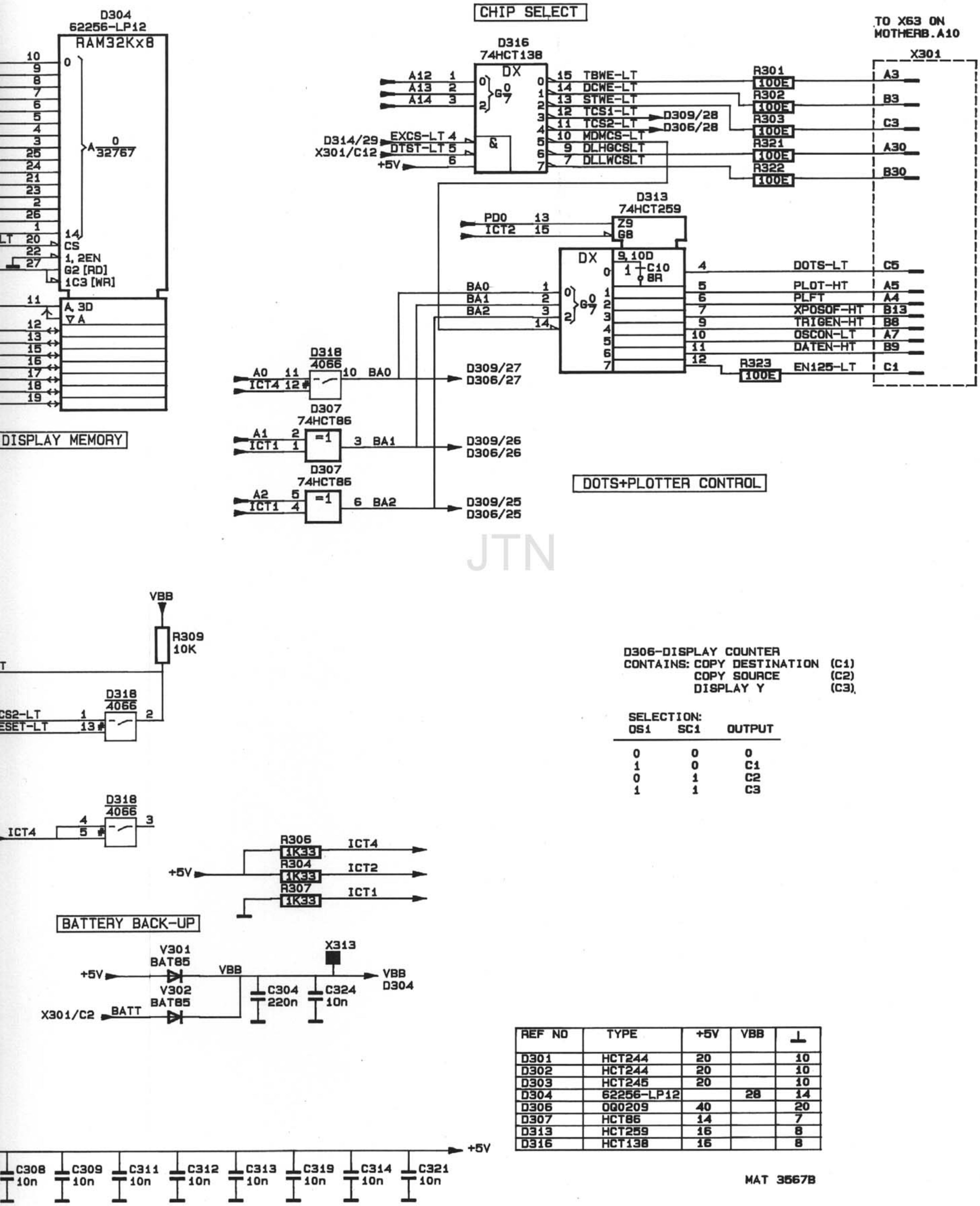
OS1	SC1	OUTPUT
0	0	0
1	0	C1
0	1	C2
1	1	C3

REF NO	TYPE	+5V	VBB	⊥
D301	HCT244	20		10
D302	HCT244	20		10
D303	HCT245	20		10
D304	62256-LP12		28	14
D306	0Q0209	40		20
D307	HCT86	14		7
D313	HCT259	16		8
D316	HCT138	16		8

Figure 14.13 Circuit diagram of DCL unit, display memory



DISPLAY COUNTER
D306
0Q0209
X307
D304
62256-LP12
RAM32Kx8
DISPLAY MEMORY
DATA
DATA BUS BUFFER
X304
D303
74HCT245
FROM X63 ON MOTHERB.A10
X301
R313 100K
D314/17 DSOSEL-LT
R/W D309/29 D314/39 D306/29
BATT
RESET-LT
V302 D318/5
ADRESS BUS BUFFER
D301 74HCT244
D302 74HCT244
ADDRESS BUS FROM µPROCESSOR
DATA BUS FROM µPROCESSOR
VBB
R309 10K
RCS2B-LT
D318 4066
D314/2 X301/C7
RCS2-LT
ICT4
BATTERY BACK-UP
V301 BAT85
V302 BAT85
X301/C2
+5V
+5VIN
C317 100n
L301 82uH
C316 220u
C318 100u
C301 10n
C302 10n
C303 10n
C306 10n
C307 10n
C308 10n
C309 10n
C311 10n
C312 10n
C313 10n
C322 10n
C323 10n
C326 10n



D306-DISPLAY COUNTER
CONTAINS: COPY DESTINATION (C1)
COPY SOURCE (C2)
DISPLAY Y (C3)

SELECTION:

OS1	SC1	OUTPUT
0	0	0
1	0	C1
0	1	C2
1	1	C3

REF NO	TYPE	+5V	VBB	⊥
D301	HCT244	20		10
D302	HCT244	20		10
D303	HCT245	20		10
D304	62256-LP12		28	14
D306	0Q0209	40		20
D307	HCT86	14		7
D313	HCT259	16		8
D316	HCT138	16		8

MAT 3567B

Figure 14.13 Circuit diagram of DCL unit, display memory

15 ACL UNIT (A14)

The ACL (Acquisition ControL) unit consists of:

- trigger control
- CCD + ADC timing
- average and interpolation circuit
- delay counter (PM3355/57 only)

15.1 TRIGGER CONTROL

The trigger control determines the start of the acquisition.
A timing diagram of the trigger control is given in figure 15.1.

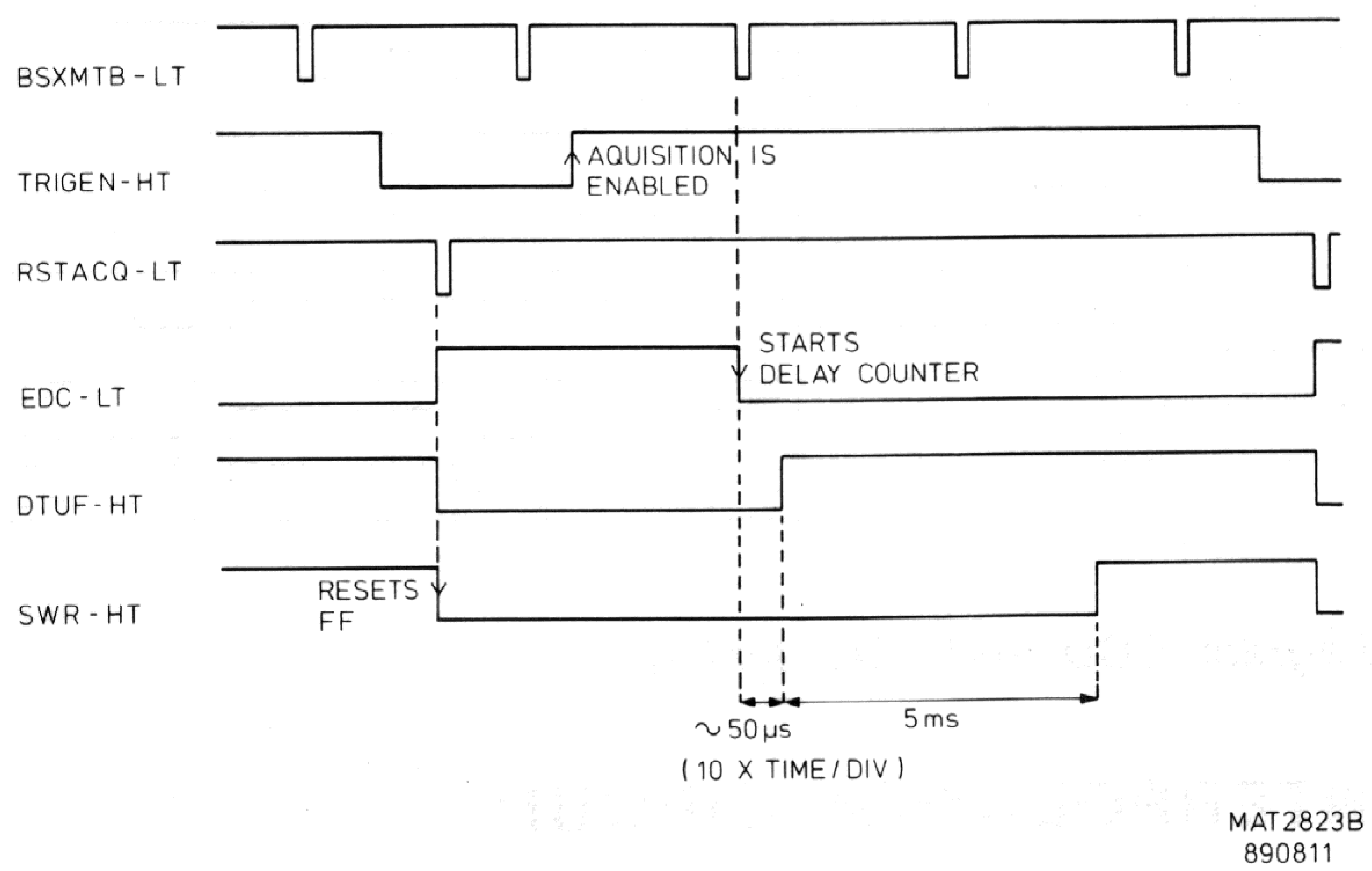


Figure 15.1 Timing diagram of the trigger control.
(TB = 5 μs and PRE-TRIG = 0)

At the moment that TRIGEN-HT is low and RSTACQLT-LT becomes low, flip- flops D403 and D404 are reset.
Now TCINN-HT, generated by the microprocessor, can go high after the acquisition counter has counted the pre-trigger value. Then TRIGEN-HT is high again so that the acquisition is enabled.
The high level of TCINN-HT clocks D404, as a result D404-9 is high and D404-2 is enabled waiting for a new trigger signal BSXMTB-LT. When this signal is low, then EDC-LT is low and starts the delay counter.
At the moment that the EDC has counted, signal DTUF-HT is high which enables D402 and therefore SWTB is clocked through.

15.2 CCD + ADC TIMING

The clock pulse OLCLK-HT is derived from D314 (on unit A13). The pulse is 800 kHz for the P-mode and 640 kHz for the D-mode and is applied to the timer D409. Enabled by a high level on pin 10, this counter operates and the outputs Q0 (400/320 kHz), Q1 (200/160 kHz) and Q2 (100/80 kHz) are fed to D411. D408 serves for synchronisation between SC0 and WRSMP-HT.
The PAL (Programmable Array Logic) chip D411 generates several control pulses for the CCD logic.
The signals DISEV-HT, DISOD-HT, RSTOD-LT, RSTEV-LT, SAMPLEHT, INTOD-HT and INTEV-HT are fed to the P^2CCD output circuit on unit A18. The signals STCONV- HT, CHSEL0-HT and CHSEL1-HT are fed to the ADC on unit A15.

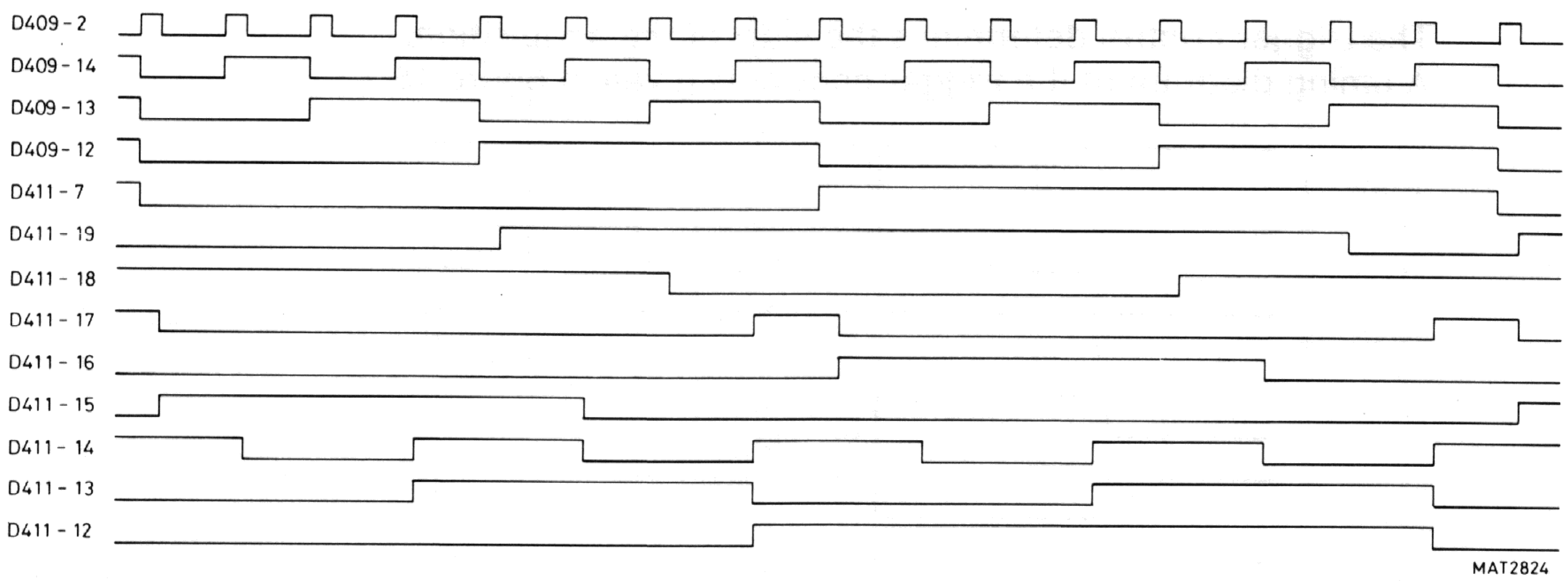


Figure 15.2 Timing diagram CCD and ADC timing

15.3 AVERAGE AND INTERPOLATION CIRCUIT

The ADC bus is generated on the ADCDAC unit A15. This bus is applied to the signal processor device D412.
The P^2CCD is split up into two parts (EVEN and ODD channel) and the samples of the EVEN channel have another gain and offset than the ODD channel. D412 averages these differences according to the formula

$$Am = \frac{An + (An - 1)}{2}$$

An = value of n-th sample
Am = value of averaged sample

Next D412 calculates also 512 linear interpolated points between each of the 512 samples according to the formula

$$Ac = \frac{Am + (An - 1)}{2}$$

Ac = value of interpolated sample

These averaged and interpolated samples are written into the acquisition memory for signal manipulation, see chapter 14.
The output bus PD0... PD7 is applied to the memories on unit A13 for display manipulation and to the Y-DAC latch D413.
When XYDLE-HT is high, this device is enabled to receive the PD-bus and transfers it to the YDAC0... YDAC7 bus.
This bus is fed to the Y-DAC on the ADCDAC unit A15.
The four least-significant bits ED0... ED3 are applied to the P^2CCD panel A18. These lines preset the ACE on this unit.

15.4 DELAY COUNTER

The total delay counter is formed by D441, D442, D443 and D444 on this unit and D801 on unit A18.
Signal DCCLK is received from the ACE D801 on unit A18 and is the clock for this counter. The trigger delay is determined by the value on the data bus PD0...3 and after the counter has counted the presetted value, the output DTTC-LT becomes low. This pulse is routed again to the ACE D801 on unit A18.

15.5 ACQUISITION FLOW

At the falling edge of signal BSXMTB-LT, D flipflop D404 is clocked. If the D-input is HIGH then EDC-LT is LOW (enable signal). This means that the sample clock (100 or 125 MHz) will clock the DELAY COUNTER.

Signal SWTB is the clock for the DELAY COUNTER, the frequency of this clock depends on the time-base position: 100 kHz ... 8 Hz.
The ACE on unit A18 is a 16x divider. So signal DCCLK will be 100 kHz/16 ... 8 Hz/16. This pulse is routed to the DELAY COUNTER D441 ... 444 and forms thus a total delay (D441 ... 444 is MSB and D801 is LSB). As a result the DTUF-HT from D801 indicates that the DELAY COUNTER is ready.

This means that now can be started with the acquisition of the samples for the screen (512, 2048 or 4096 samples).

The choise between the P^2CCD (P-) mode and the DIRECT (D-) or ROLL (R-) mode is made by signal EN100-LT/EN125-LT for PM3355 (OSCON-LT for PM3350A). This signal controls the multiplexer, formed by the three NAND-gates of D406 on this unit.

- If LOW, then the P-mode is selected. Now signal CDRD-HT is switched to the output of the multiplexer.
- If HIGH, then the D- or R- mode is selected and the synchronized DTUF--HT (=DLTRG-HT is connected to the output of the multiplexer.

The resulting signal ENCVCNHT is then routed to the READ OUT counter (D218 on unit A12).

This counter generates the CVCNRYLT pulse, applied to flipflop D403 on this unit. Output SWR---HT of this flipflop indicates that all samples are taken in the ACQUISITION memory and that these samples has to be written into the DISPLAY memory on unit A13.

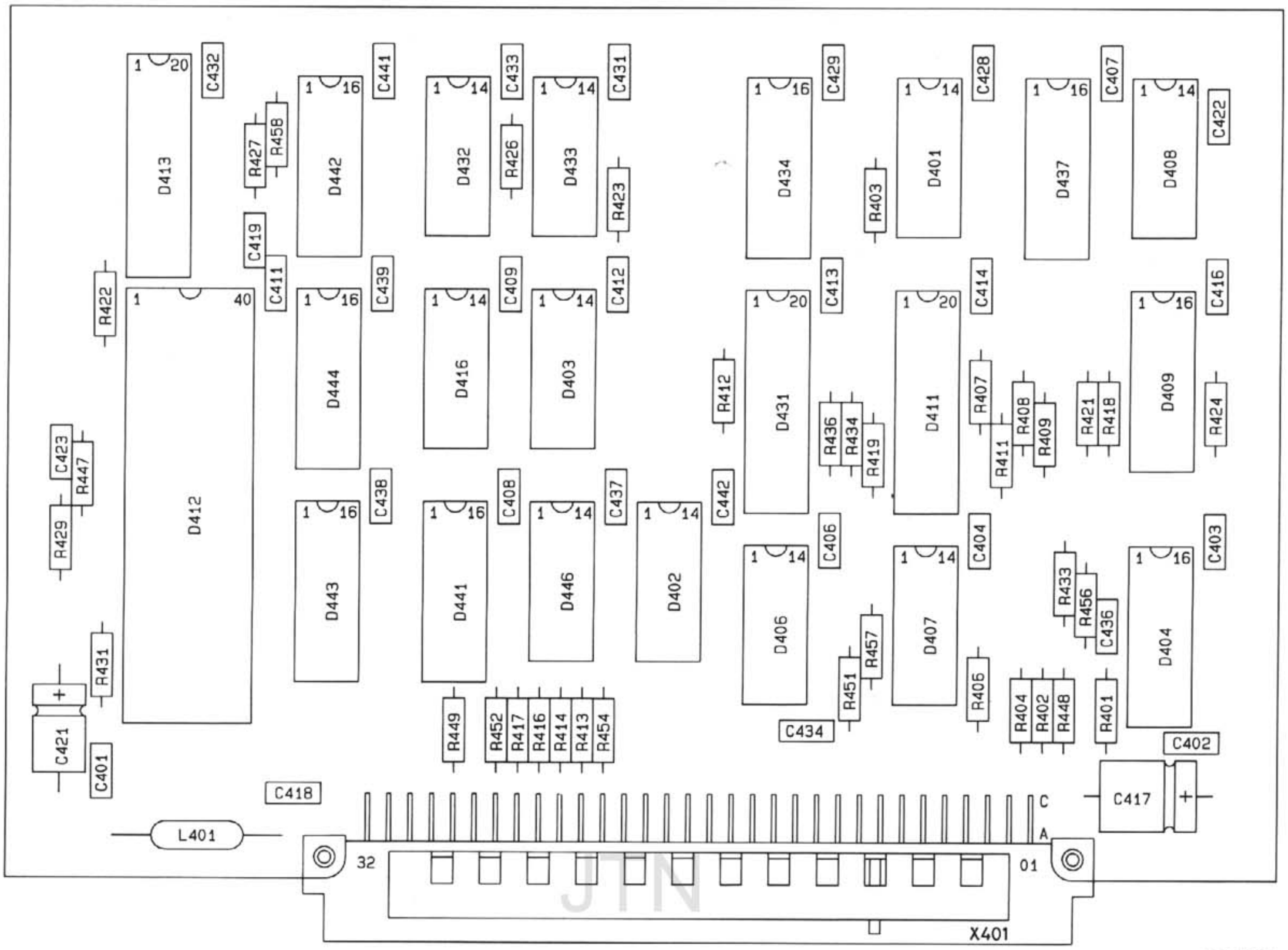
15.6 SIGNAL NAME LIST

Signal name	Description	Signal source	Signal destination(s)
AD0...7	Data bus from ADC circuit	N505	D412
BSXMTB-LT		D4103	D401
CCDENBHT	CCD enable	R447	R1637
CDRD-HT	CCD read	R883	D404 - D411
CHSEL0HT	Channel select 0	D411	N505
CHSEL1HT	Channel select 1	D411	N505
CVCNRYLT	Conversion counter ready	D218	D403 - D406
DATEN-HT	Data enable	D313	D416
DLENX-HT	Data latch enable X	D219	D412
DMODE-HT	Direct mode	D412	D408
DMODE-LT	Direct mode	D412	D408
DISEV-HT	Discharge even	R403	D921 - D922
DISOD-HT	Discharge odd	R404	D921 - D922
DLTRG-HT	Delay trigger	D402	D314 - D406
DTUF-HT	Delay trigger underslow	R884	D402
ED0...3	Buffered data bus	R413...R417	D801
EDC--LT	Enable delay counter	R401	D221 - D801
EN100-LT	Enable P-mode/100 MHz	D313	D407 - D801 - D5202 - R862 - R5128
EN125-LT	Enable P-mode/125 MHz	D313	D407 - D5202 - R5113
ENCVCN-HT	Enable conversion counter	D406	D218
INVA-HT	Invert A	D412	D407
INVA0-HT	Invert address A0	D407	D307
INTEV-HT	Integrate even	R411	D911
INTOD-HT	Integrate odd	R409	D901
MIDCLK	Mid clock	D314	D412
MDOE-LT	MD output enable	D314	D412
OLCLK-HT	Output logic clock	D314	D401 - D409
OSCON	Enable P-mode/100 MHz	D313	D407- D801 - R862
PD0...7	Buffered bidirectional tri-state data bus	D303	D413
RSTACKLT	Reset acquisition	D202	D402 - D403
RSTEV-LT	Reset even	R407	R751
RSTH-LT	Reset	D314	D401
RSTH-HT	Reset	D401	D412
RSTOD-LT	Reset odd	R406	R781
RSSW-HT	Reset slow clock	R407	D801
SDA1	Serial data 1	D223	R223 - D412
SC0--HT	State counter 0	D314	D407 - D408
SC1--HT	State counter 1	D314	D408
SCL1	Serial clock 1	D223	D412
SAMPLEHT	Sample clock CIH	R408	D411 - D922
STCONVHT	Start conversion	D411	N505
SWCK	Slow clock	R412	D801
SWTBCLK	Slow time base clock	D409	D218 - D411
SWR--HT	Sweep ready	D403	D221
SWR--LT	Sweep ready	D403	D412
SWTB	Slow time base	D218	D412 - D801
TBSYNCHT	Time base synchronisation	D403	D402 - D412
TBSYNCLT	Time base synchronisation	D403	D412

Signal name	Description	Signal source	Signal destination(s)
TCEV-LT	Transport clock even	882	D401 - D408 - D411
TCINN-HT	Terminal count in	D314	D404
TRGLTC		D403	D412
TRIGENHT	Trigger enable	D313	D403 - D404 - D406
WRSMP-HT	Write sample	D412	D314
XYDLE-HT	A DAC and Y DAC latch enable	D314	R427
YDAC0...7	Data bus for Y DAC	D413	N506

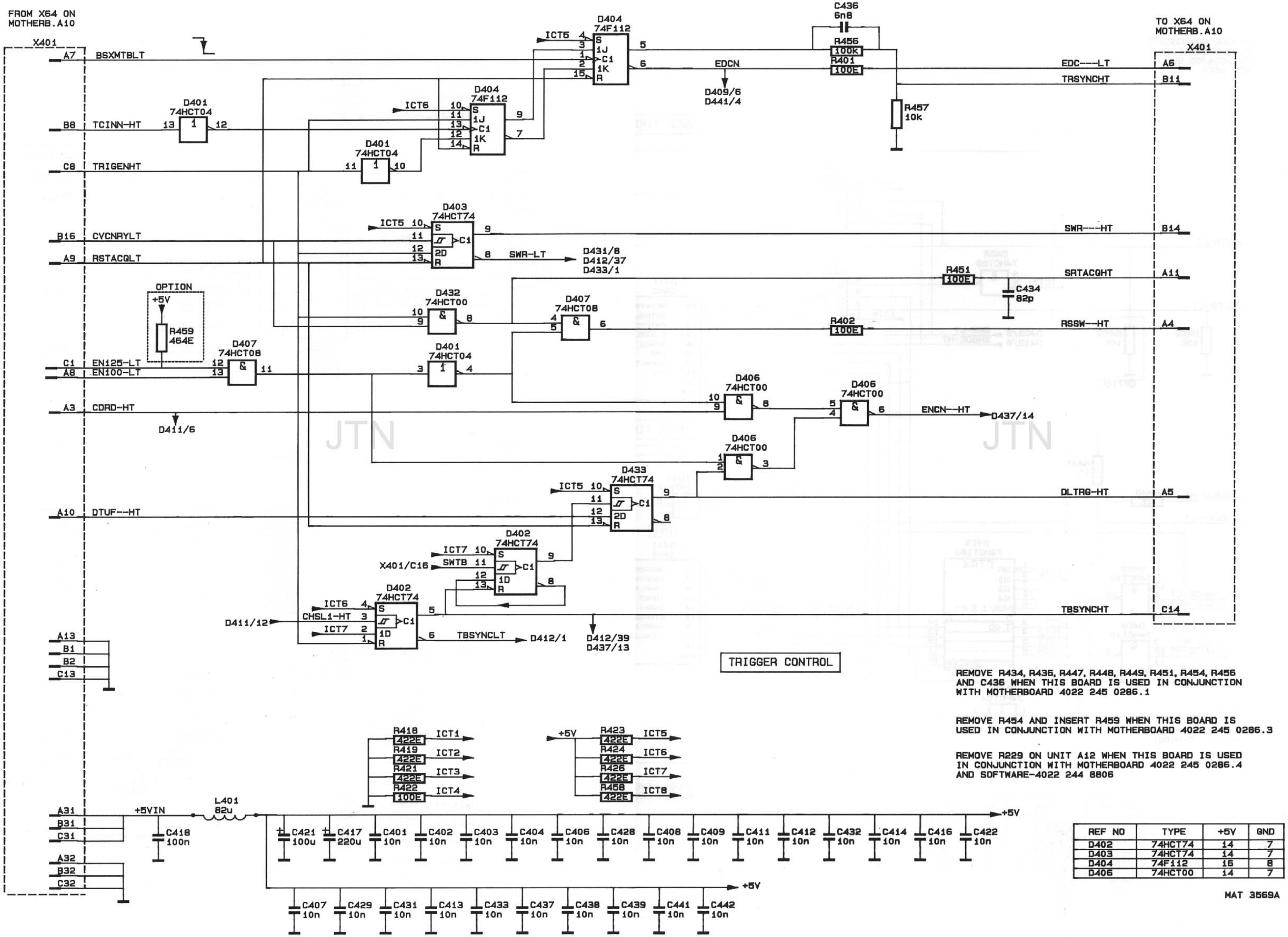
NOTE: Signal OSCON-LT and EN100-LT, generated by D313/10 on unit A13 are identical.

A14



MAT3851

Figure 15.6 ACL unit p.c.b.



REMOVE R434, R436, R447, R448, R449, R451, R454, R456 AND C436 WHEN THIS BOARD IS USED IN CONJUNCTION WITH MOTHERBOARD 4022 245 0286.1

REMOVE R454 AND INSERT R459 WHEN THIS BOARD IS USED IN CONJUNCTION WITH MOTHERBOARD 4022 245 0286.3

REMOVE R229 ON UNIT A12 WHEN THIS BOARD IS USED IN CONJUNCTION WITH MOTHERBOARD 4022 245 0286.4 AND SOFTWARE-4022 244 8806

REF NO	TYPE	+5V	GND
D402	74HCT74	14	7
D403	74HCT74	14	7
D404	74F112	16	8
D406	74HCT00	14	7

MAT 3569A

Figure 15.4 Circuit diagram of ACL unit: part 1

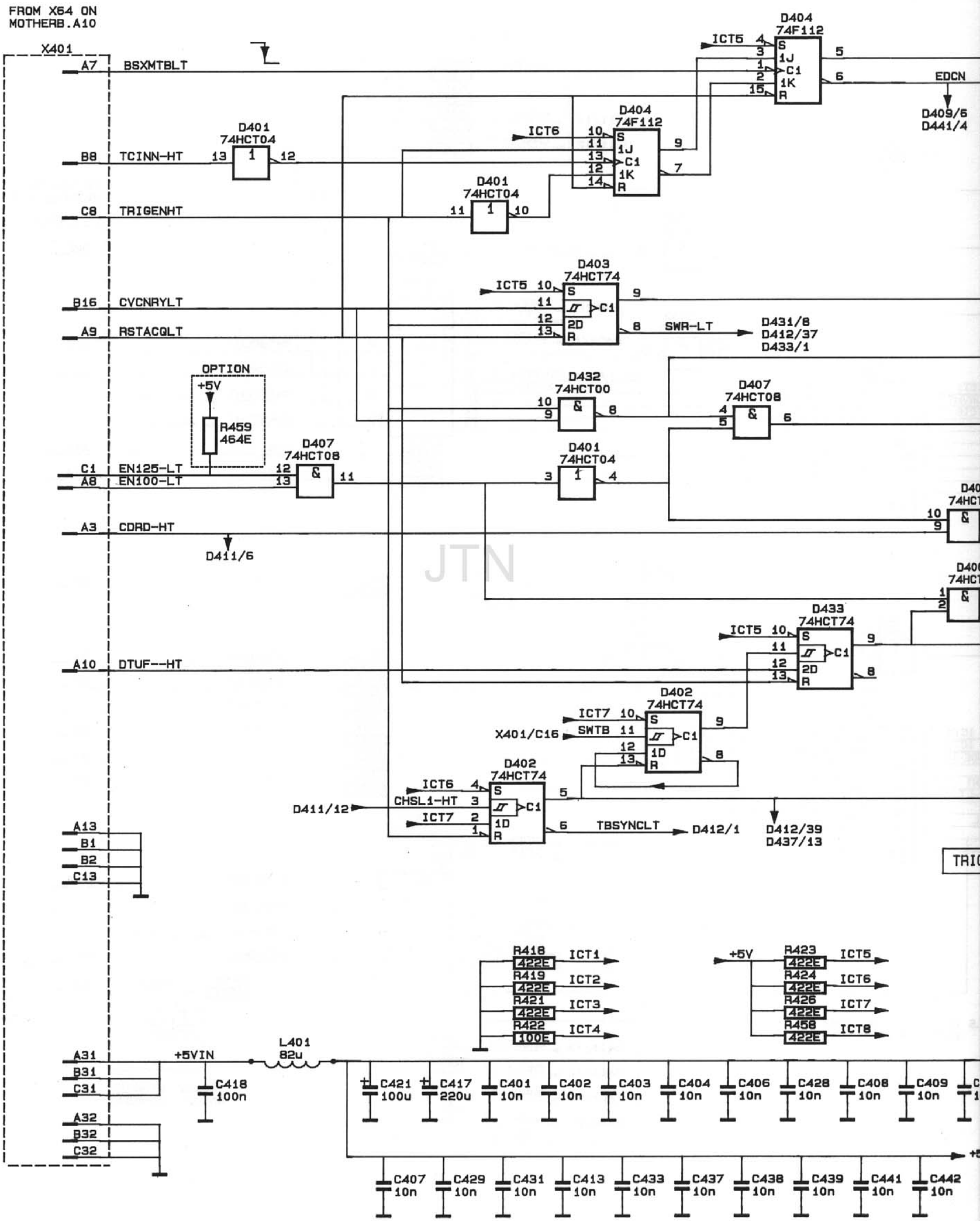
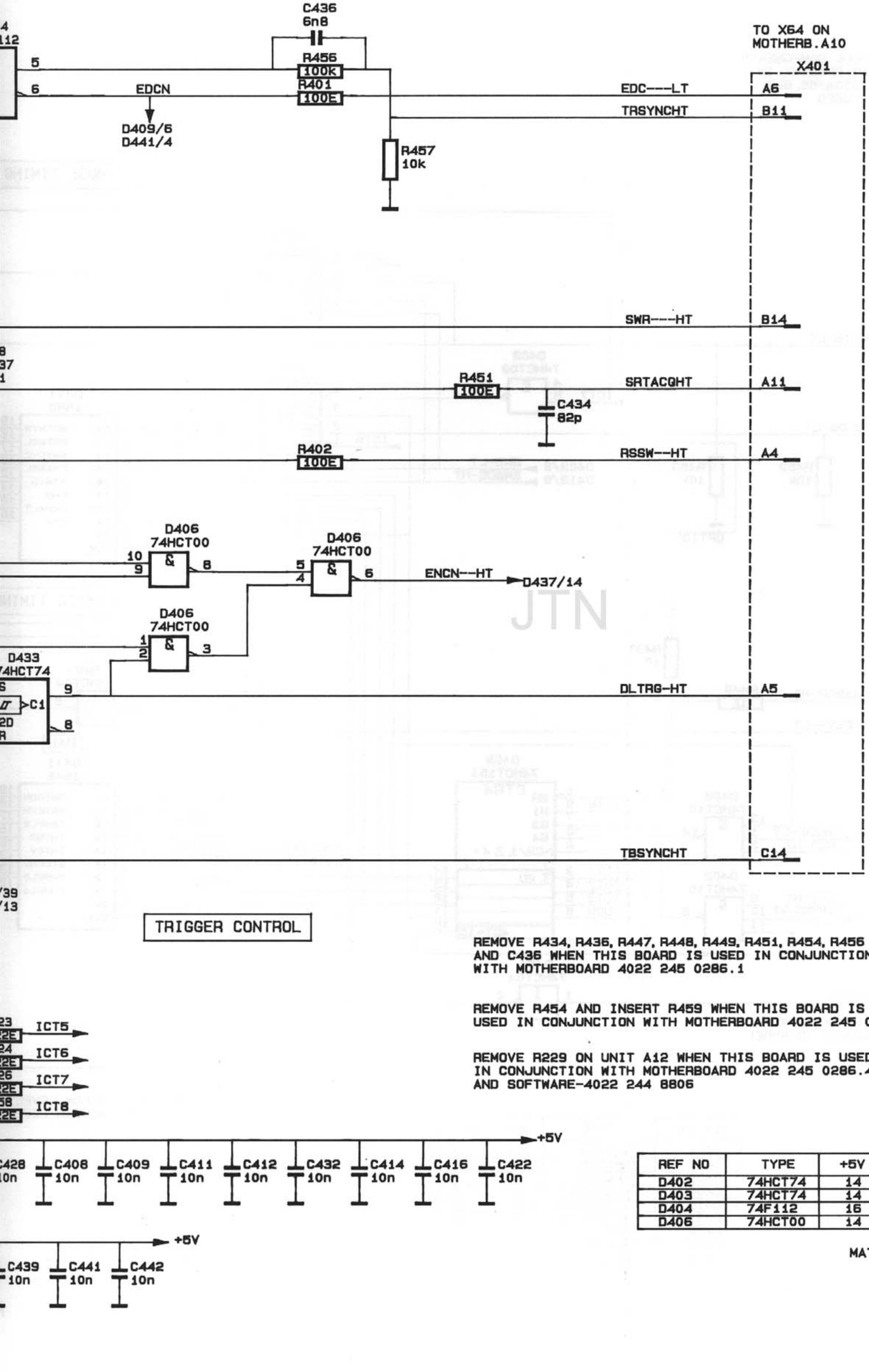


Figure 15.4 Circuit diagram of ACL unit: part 1



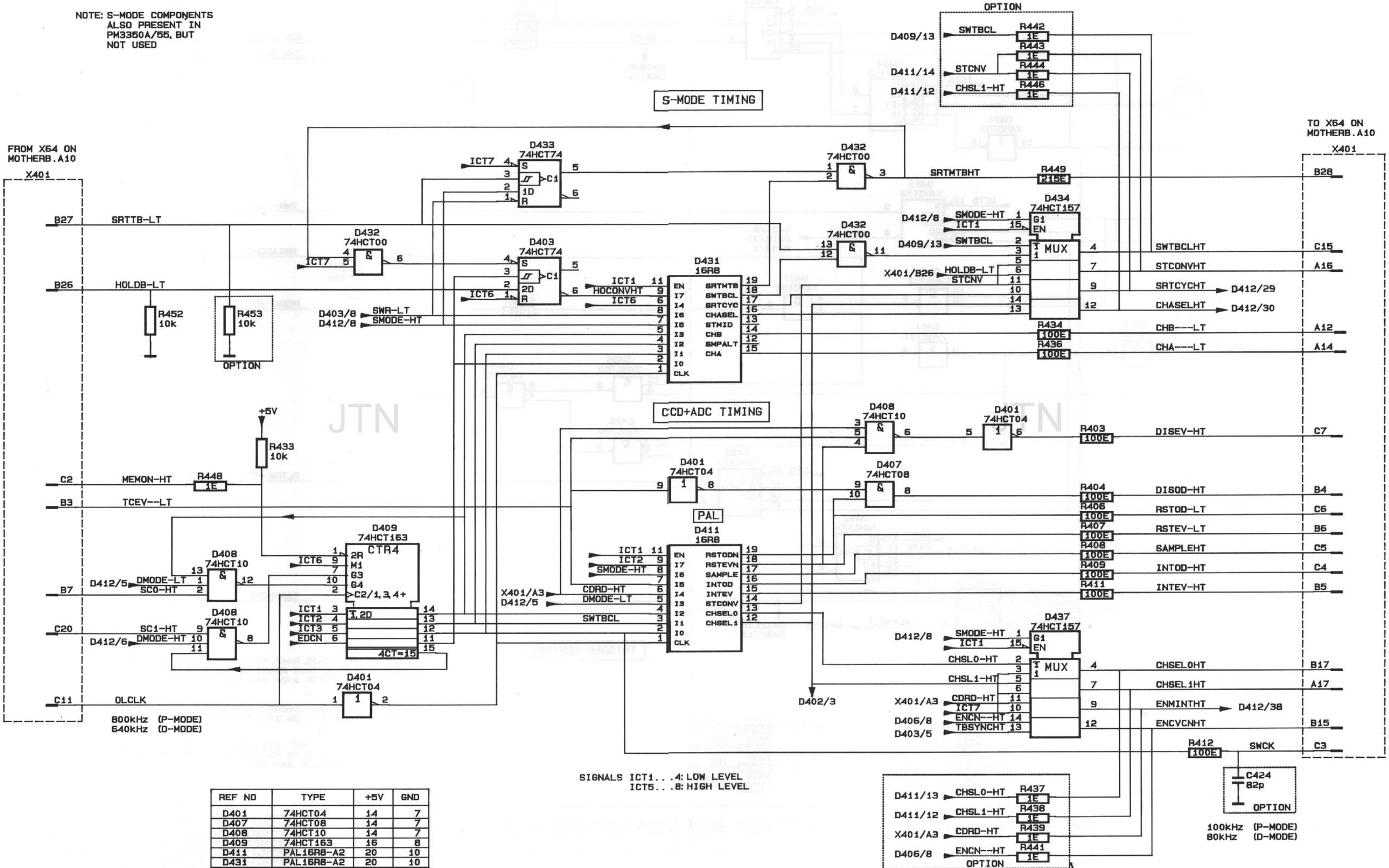
REMOVE R434, R436, R447, R448, R449, R451, R454, R456 AND C436 WHEN THIS BOARD IS USED IN CONJUNCTION WITH MOTHERBOARD 4022 245 0286.1

REMOVE R454 AND INSERT R459 WHEN THIS BOARD IS USED IN CONJUNCTION WITH MOTHERBOARD 4022 245 0286.3

REMOVE R229 ON UNIT A12 WHEN THIS BOARD IS USED IN CONJUNCTION WITH MOTHERBOARD 4022 245 0286.4 AND SOFTWARE-4022 244 8806

REF NO	TYPE	+5V	GND
D402	74HCT74	14	7
D403	74HCT74	14	7
D404	74F112	16	8
D406	74HCT00	14	7

MAT 3569A

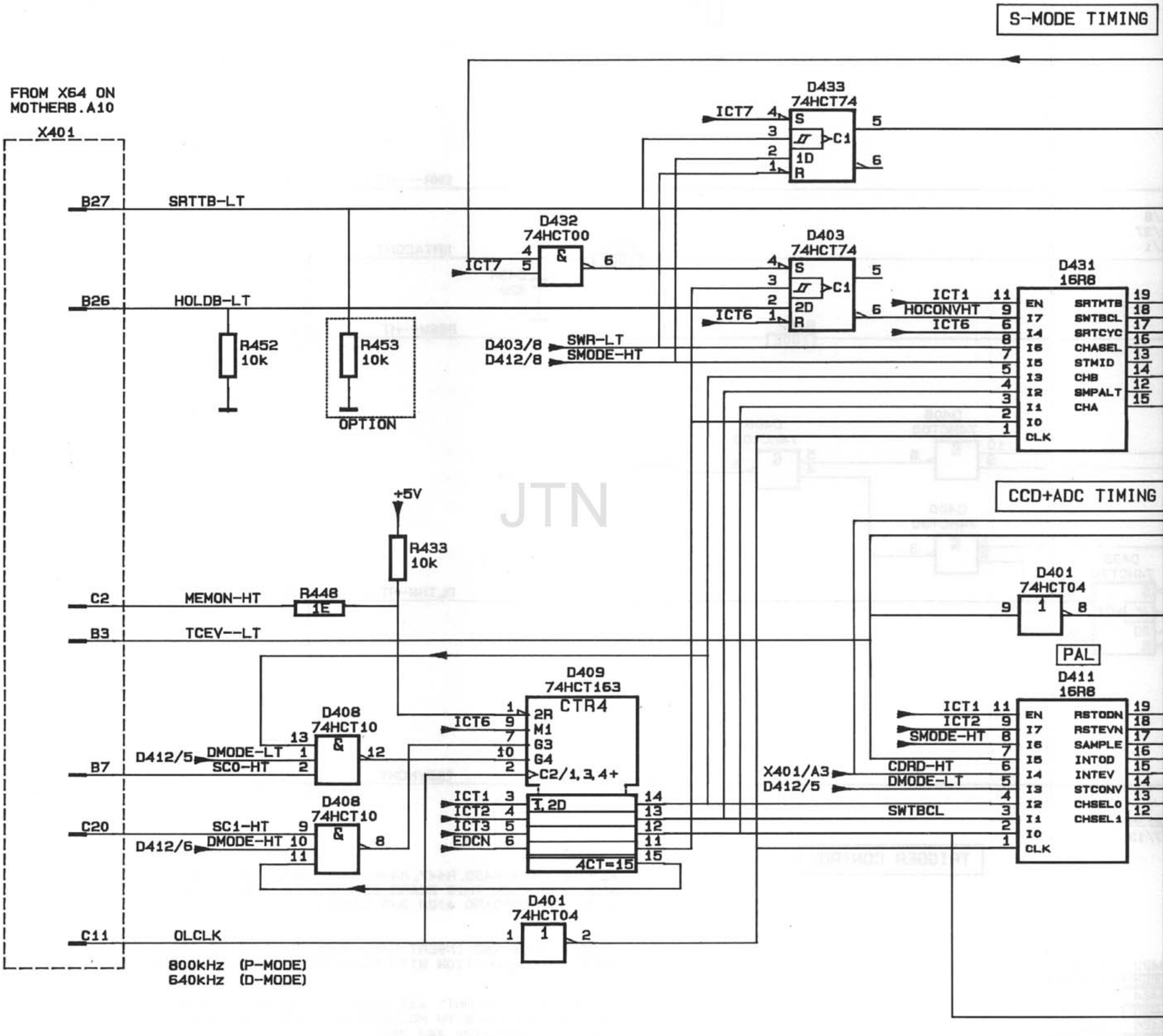


REF NO	TYPE	+5V	GND
D401	74HCT04	14	7
D407	74HCT08	14	7
D408	74HCT10	14	7
D409	74HCT163	16	8
D411	PAL16R8-A2	20	10
D431	PAL16R8-A2	20	10
D432	74HCT00	14	7
D433	74HCT74	14	7
D434	74HCT157	16	8
D437	74HCT157	16	8

MAT 3570A

Figure 15.5 Circuit diagram of ACL unit: part 2

NOTE: S-MODE COMPONENTS
ALSO PRESENT IN
PM3350A/55, BUT
NOT USED



SIGNALS ICT1...4: LOW LEVEL
ICT5...8: HIGH LEVEL

REF NO	TYPE	+5V	GND
D401	74HCT04	14	7
D407	74HCT08	14	7
D408	74HCT10	14	7
D409	74HCT163	16	8
D411	PAL16R8-A2	20	10
D431	PAL16R8-A2	20	10
D432	74HCT00	14	7
D433	74HCT74	14	7
D434	74HCT157	16	8
D437	74HCT157	16	8

Fig

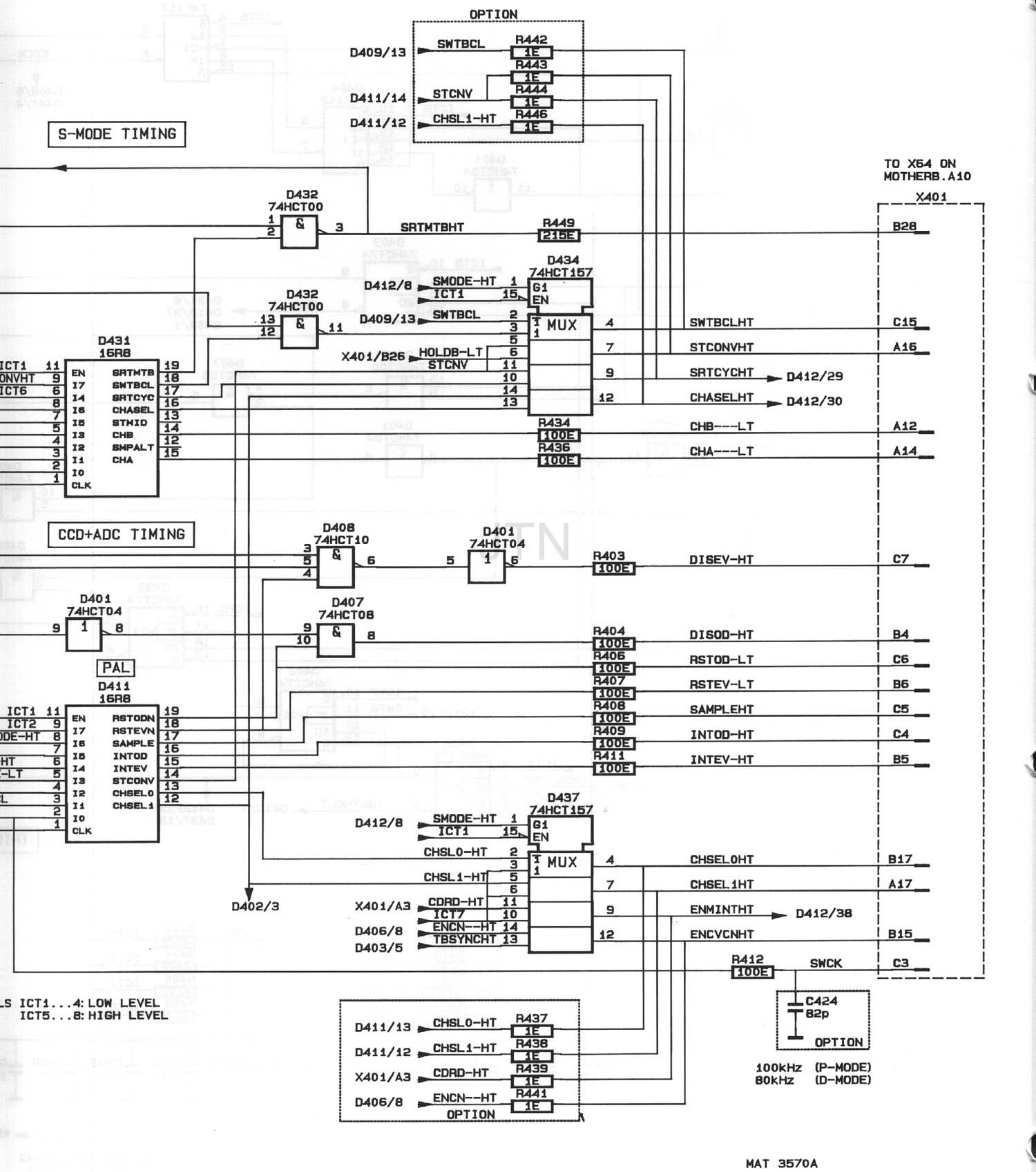
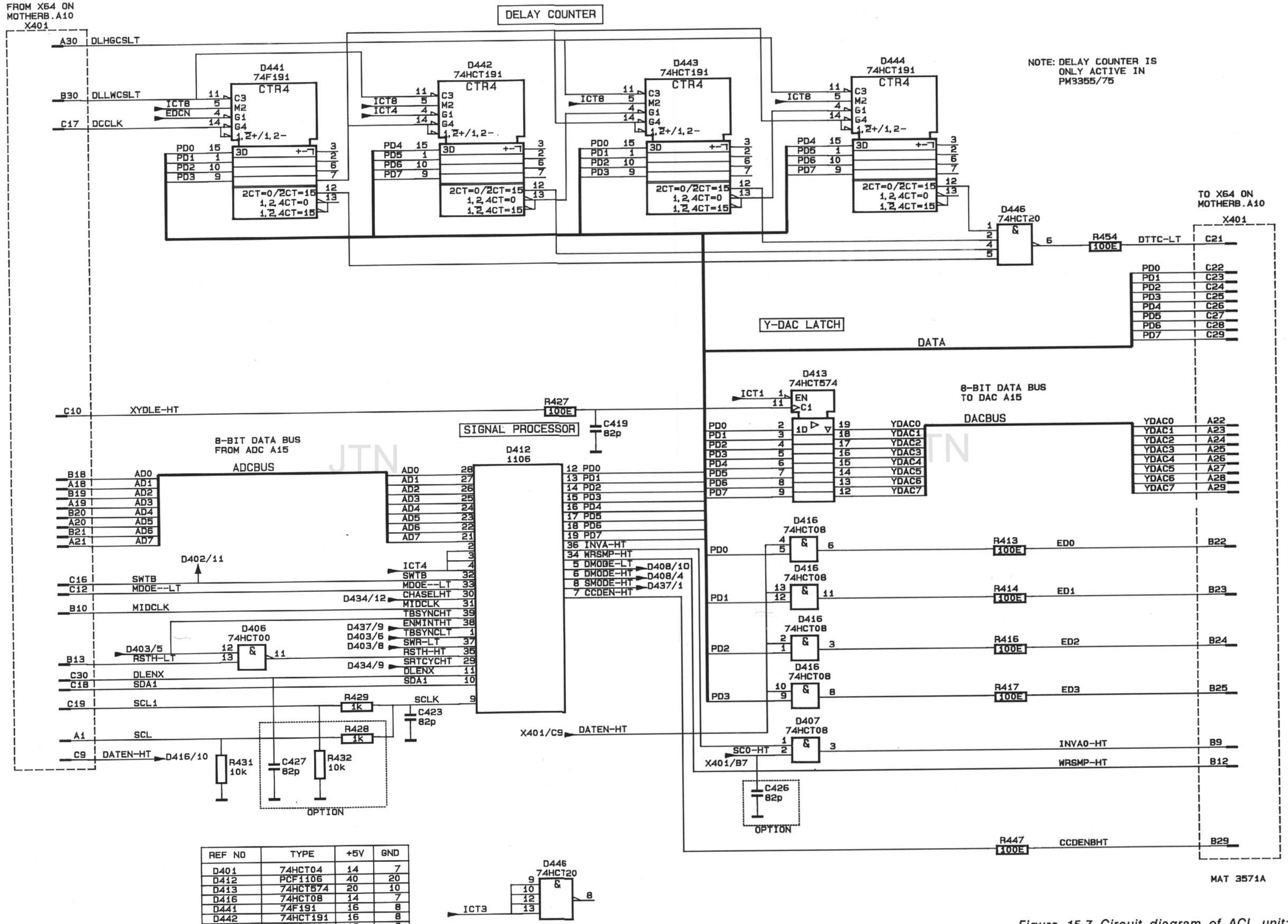
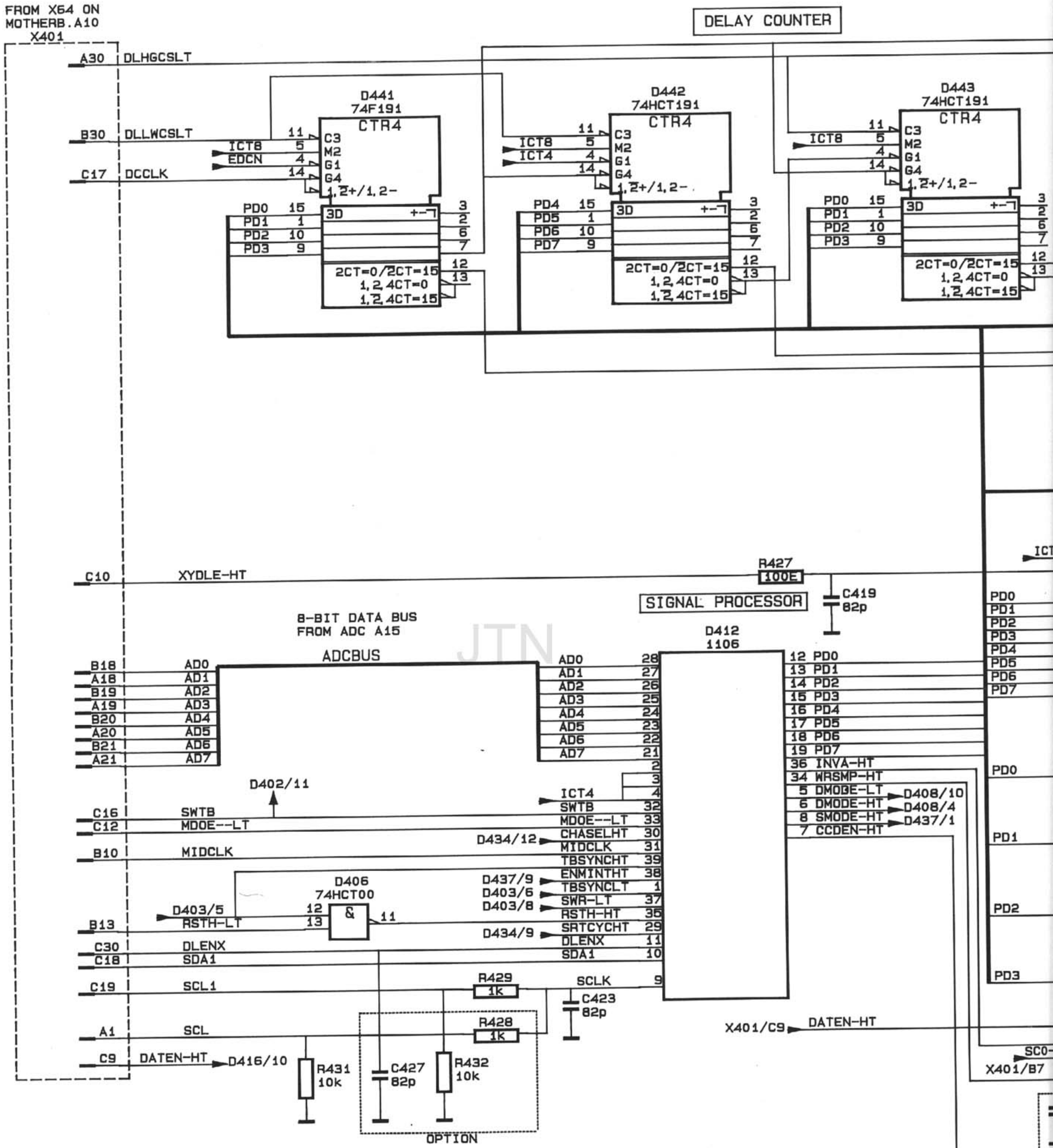


Figure 15.5 Circuit diagram of ACL unit: part 2

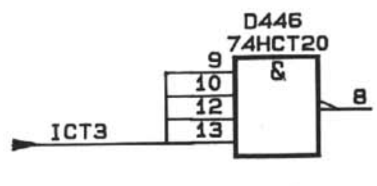


REF NO	TYPE	+5V	GND
D401	74HCT04	14	7
D412	PCF1106	40	20
D413	74HCT574	20	10
D416	74HCT08	14	7
D441	74F191	16	8
D442	74HCT191	16	8
D443	74HCT191	16	8
D444	74HCT191	16	8
D446	74HCT20	14	7

Figure 15.7 Circuit diagram of ACL unit: part 3



REF NO	TYPE	+5V	GND
D401	74HCT04	14	7
D412	PCF1106	40	20
D413	74HCT574	20	10
D416	74HCT08	14	7
D441	74F191	16	8
D442	74HCT191	16	8
D443	74HCT191	16	8
D444	74HCT191	16	8
D446	74HCT20	14	7



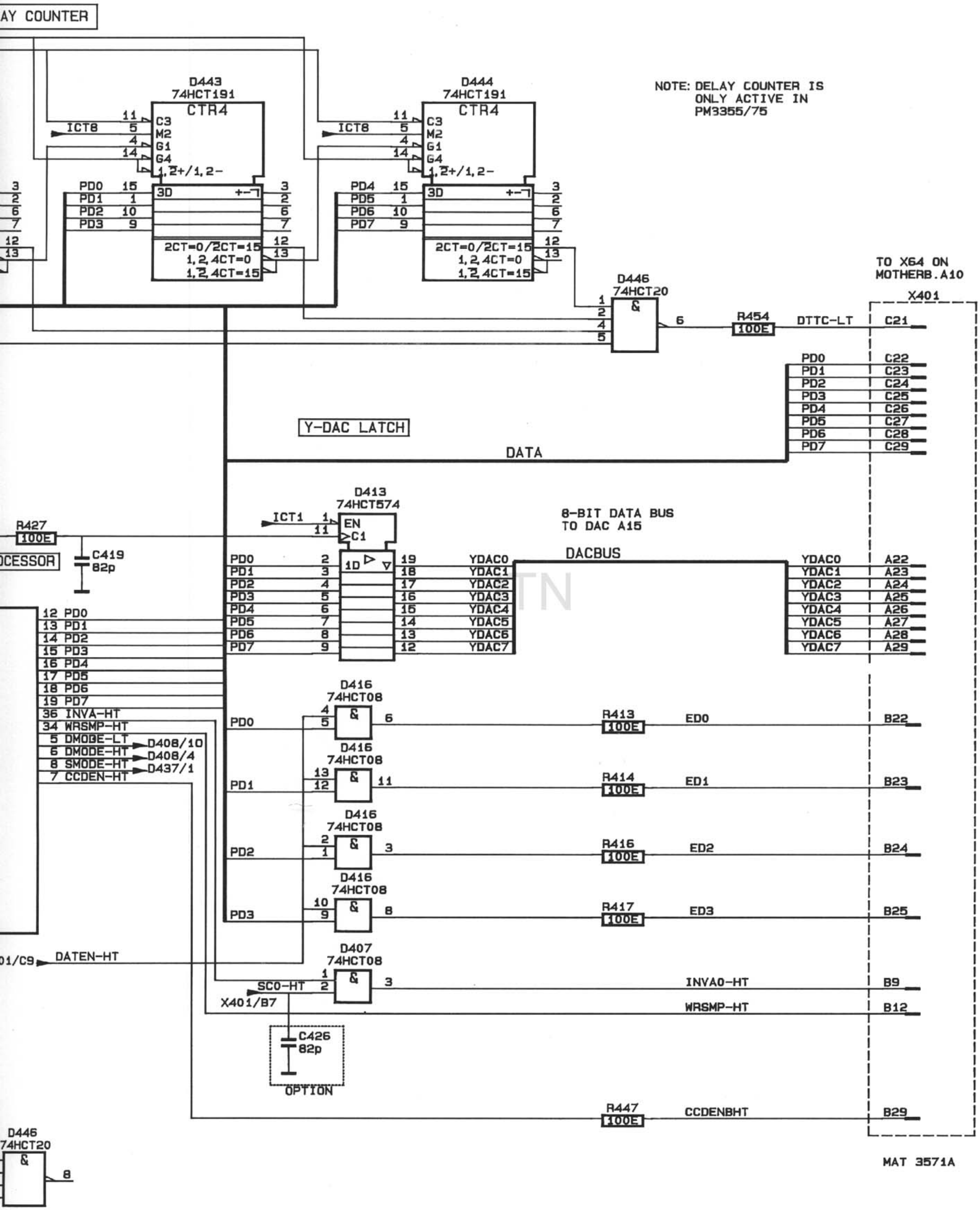


Figure 15.7 Circuit diagram of ACL unit: part 3

16 ADC DAC UNIT (A15)

The ADC DAC unit consists of:

- ADC circuit
- vertical DAC circuit (Y-DAC)
- horizontal DAC circuit (X-DAC)
- X POS switch circuit
- Z control circuit
- plot and penlift circuit

16.1 ADC CIRCUIT

The four signal samples CHAEV, CHAOD, CHBEV and CHBOD are derived from the P^2CCD unit. The samples for each channel are first fed to differential amplifier N501. This device compares both input signals and gives the following results for a sine wave signal with 10 divisions amplitude.

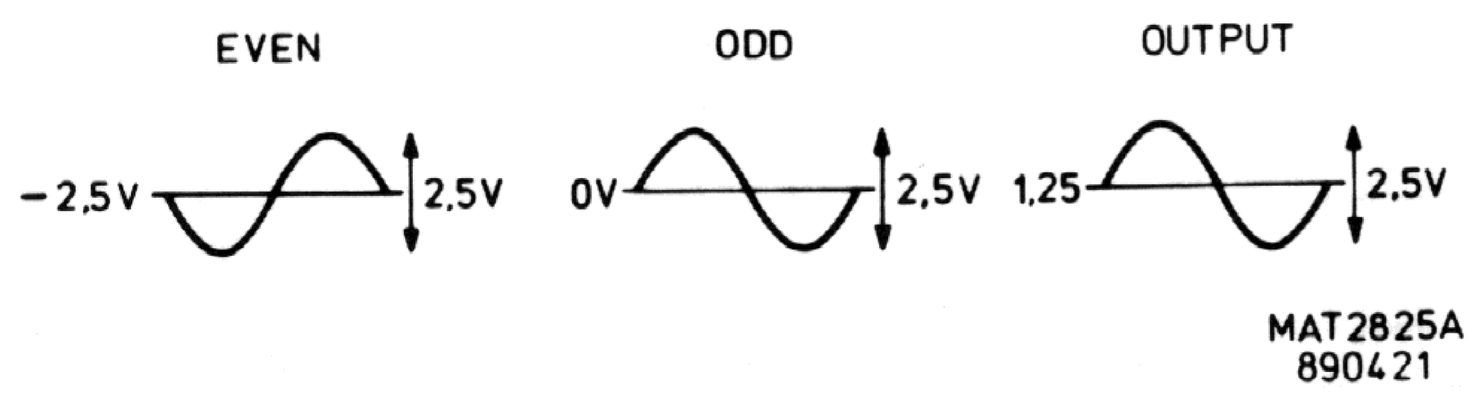


Figure 16.1 Waveforms on N501

The output signal is limited for an amplitude between -0,3 V... +3,0 V by the limiting diodes V501...V506 to protect the ADC input and then applied to the ADC N505.

This ADC, AD7824 is a high-speed-4-channel 8-bit analog-to-digital converter with a conversion time of 2,5 μs per channel. Two channels are used for the AIN1 and AIN3 signals. Next, it has two digital inputs A0 and A1 for channel selection.

CHS0	CHS1	Signal	Channel selected
0	0	AIN1	A
1	0	AIN3	B
0	1	--	--
1	1	--	--

Conversion is started at the falling edge of the STCONVLT pulse while the data AD0...7 is present on the output at the rising edge of the STCONVLT pulse.

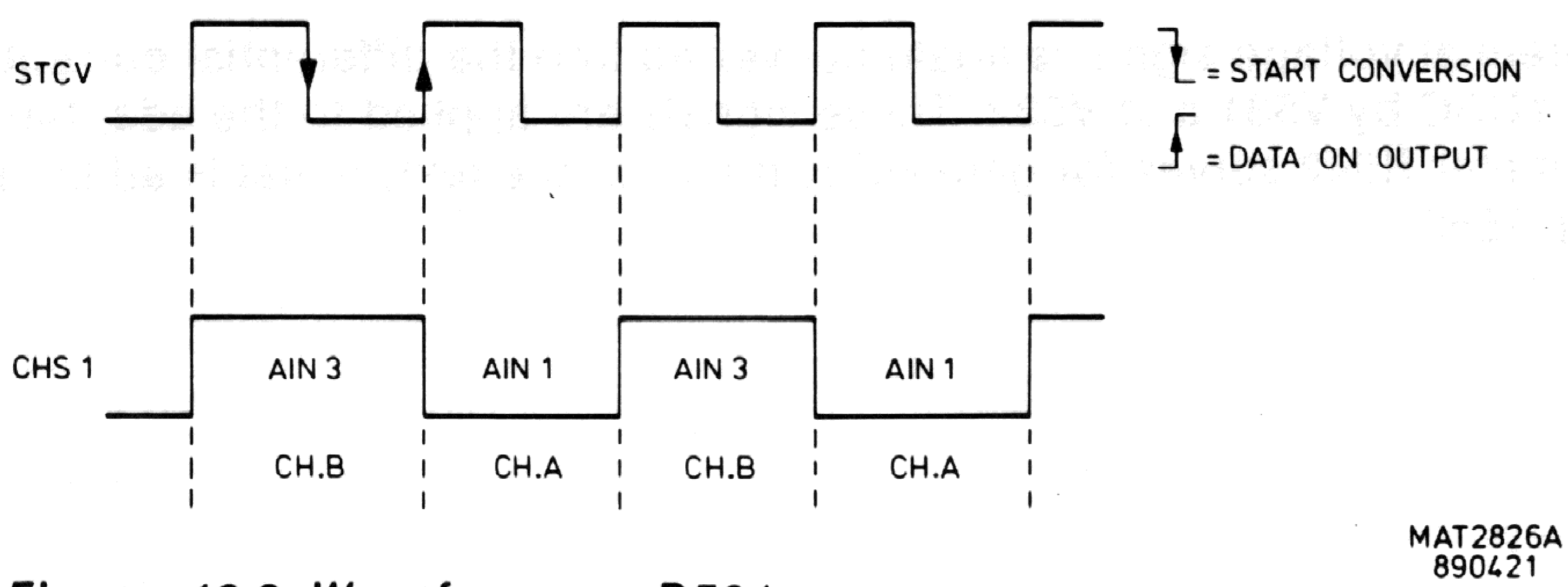


Figure 16.2 Waveform on D501

The value of the 8-bit data is determined by the input signal.
AD0...7 is 0000 0000 (00H) for an input voltage of 0 V and 1111 1111 (FFH) for an input voltage of +2,5 V. This AD-bus is applied to the ACL unit A14 for signal acquisition.

16.2 VERTICAL DAC CIRCUIT (Y-DAC)

The 8-bit Y-DAC bus derived from the ACL unit A14 is applied to DAC N506. The 8-bit digital-to-analogue converter converts the value of YDAC0...7 into a differential current signal. The reference current is 2 mA. The differential current is converted into a differential voltage by V521 and V522.

During refreshment of the 8-bit data, glitches appear on the output current. These glitches are removed by D503.

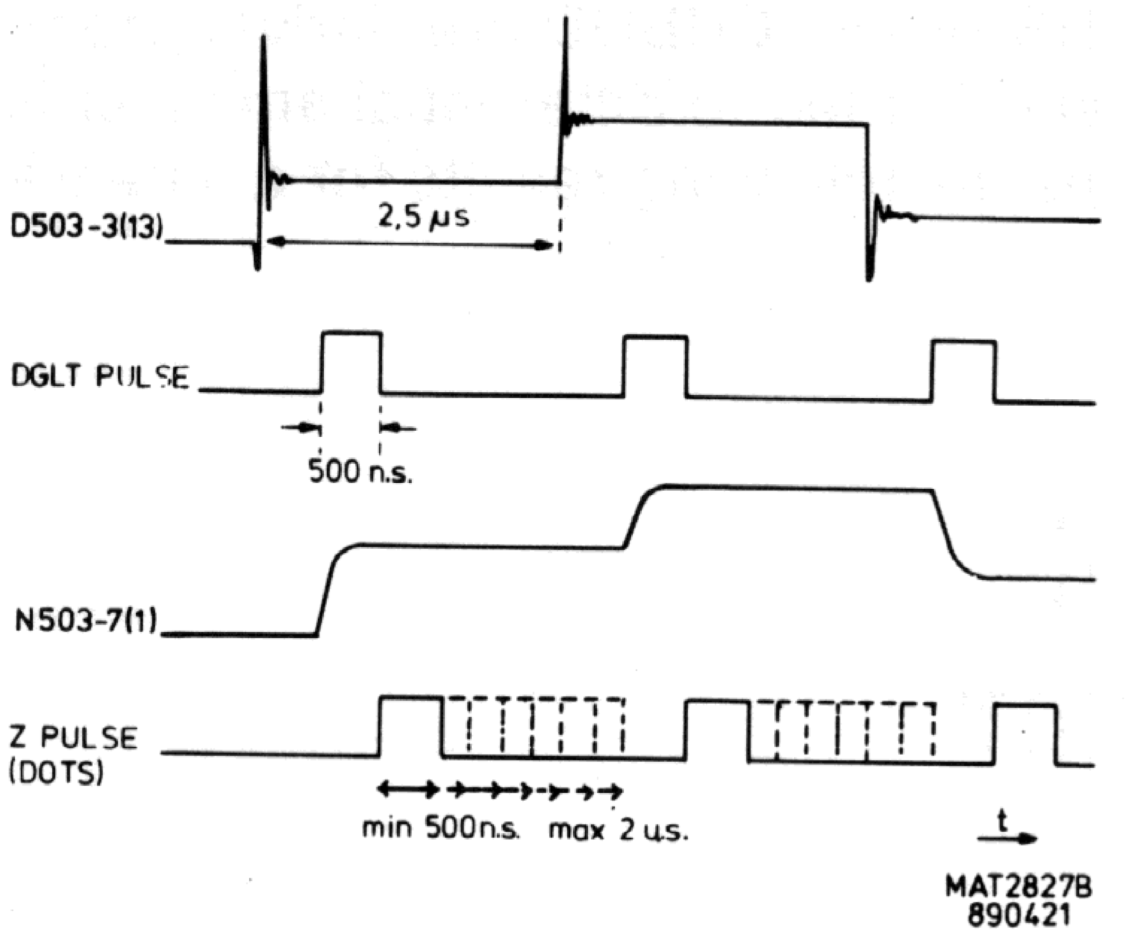


Figure 16.3 Waveform on deglitch circuit

Only when the DGLT pulse goes high, the hold capacitor C521 (C522) is charged to the value of the differential voltage. The charging time of C521-R532 (C522-R533) is much lower than the 500 ns of the DGLT pulse, so the hold capacitors will be fully charged. Because both capacitors are buffered by N503, they keep charged when DGLT is low for 2 μs until DGLT is high again. Then the capacitors will charge to the new value. Notice that DGLT is only high when the differential voltage on D503-3 (13) has become stable.

When DOT-JOIN is depressed, DOTS--LT is high. In this case, four integration capacitors C523...C527 are in circuit. The differential signal voltage is then loaded with these four capacitors. During the horizontal sweeps the Z pulse is constant high so the space between two dots is also intensified on the screen.

The + PLOT and - PLOT signals are fed to the plot and penlift circuit.

Next the differential voltage signal is again converted into the differential current signals +YDAC and -YDAC by V531 and V532. These signals are applied to the adaptation unit A16. Potentiometer R542 serves for gain adjustment for the text, offset is adjusted by potentiometer R550.

16.3 HORIZONTAL DAC CIRCUIT (X-DAC)

This circuit is basically similar to the vertical DAC circuit. However, the symmetrical current output of 10-bit DAC N507-4 (2) is converted into a asymmetrical voltage by N511. The amplitude of the sawtooth on D512-3 is 2,5 V. This signal is applied to the input of the deglitch circuit.

N513 serves as an output buffer and gives the digital sawtooth sweep of 0 V ... 5 V. This sweep is applied to the time-base unit A4.

16.4 X POS SWITCH CIRCUIT

The front-panel X POS control or R553 is switched to the POSXOUT output via a diode switch V553 ... V557. This switch is under control of the signal POSXOFHT. When POSXOFHT is low, the front-panel control POS X is active and determines the X position of the signal on the screen. But, during the time that the text is written on the screen, POSXOFHT is high. This means that the X position of the text is fixed by means of R553.

16.5 Z CONTROL

The brightness on the screen is controlled by three signals:

- PLOT--HT, dims the brightness when the instrument is in plot action.
- DOTS--LT, dims the brightness when the screen is dot-joined.
- ZON---LT, switches off the intensity during the flyback of the digital sawtooth or between two dots.

These TTL signals are first fed to D504 which converts the amplitude to 12 V. Because pin 15 is connected to +5 V the device is always enabled.

16.5.1 Plot mode

During the plot action, the signals PLOT--HT and DOTS--LT are high. This means that a part of the current source on unit A4 is floating (mainly) through resistor R565 and R566 so that the brightness on the screen is dimmed. During the flyback between two traces, signal ZON---LT is high so that the trace is fully blanked.

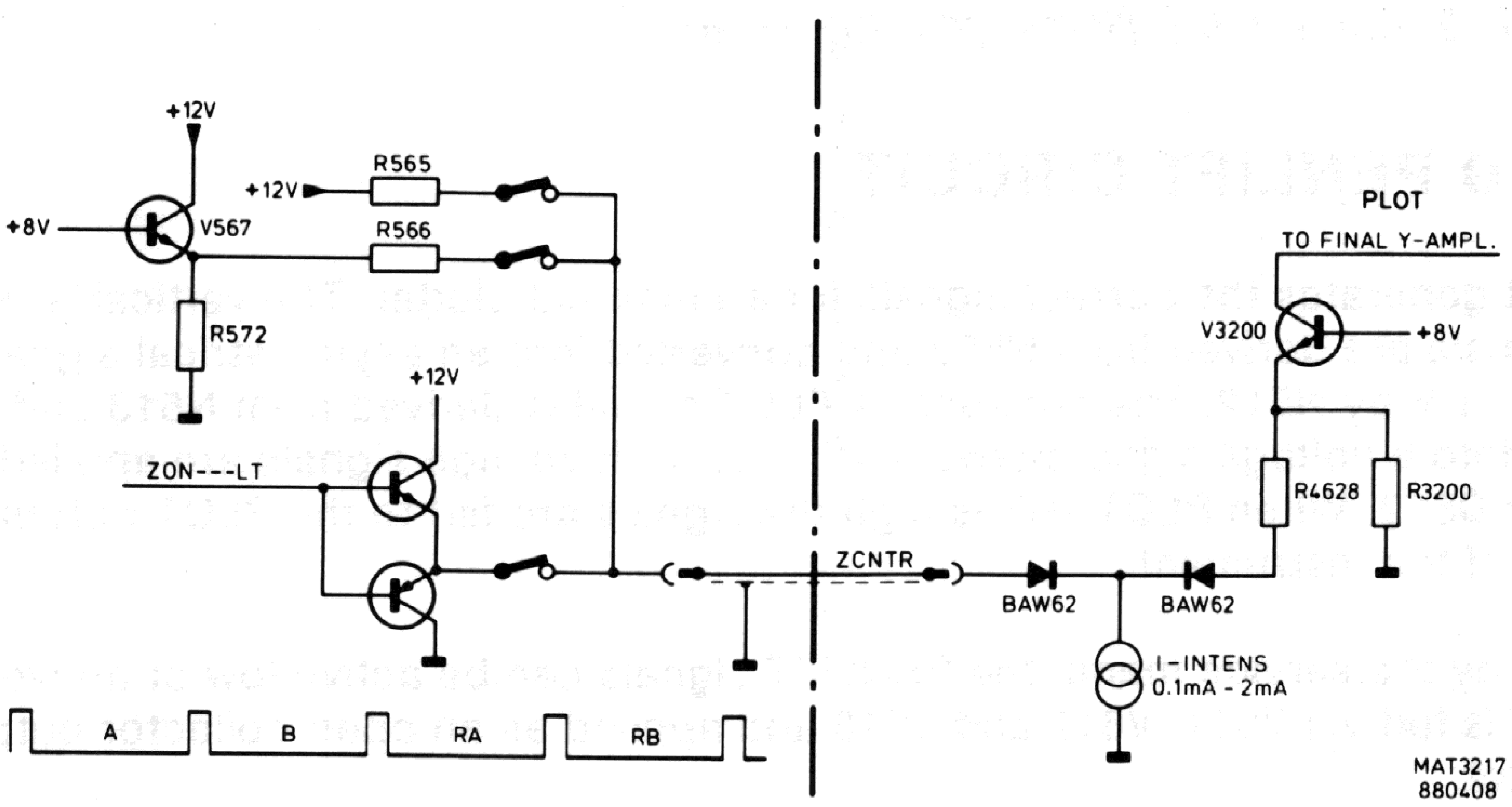


Figure 16.4 Z control fot PLOT mode

16.5.2 Dots-/dots-joined mode

In dots mode the signals PLOT--HT and DOTS--LT are low. This means that blanking is only controlled by the ZON---LT pulse. This pulse is high and thus the trace is blanked during the flyback and the time between the dots.

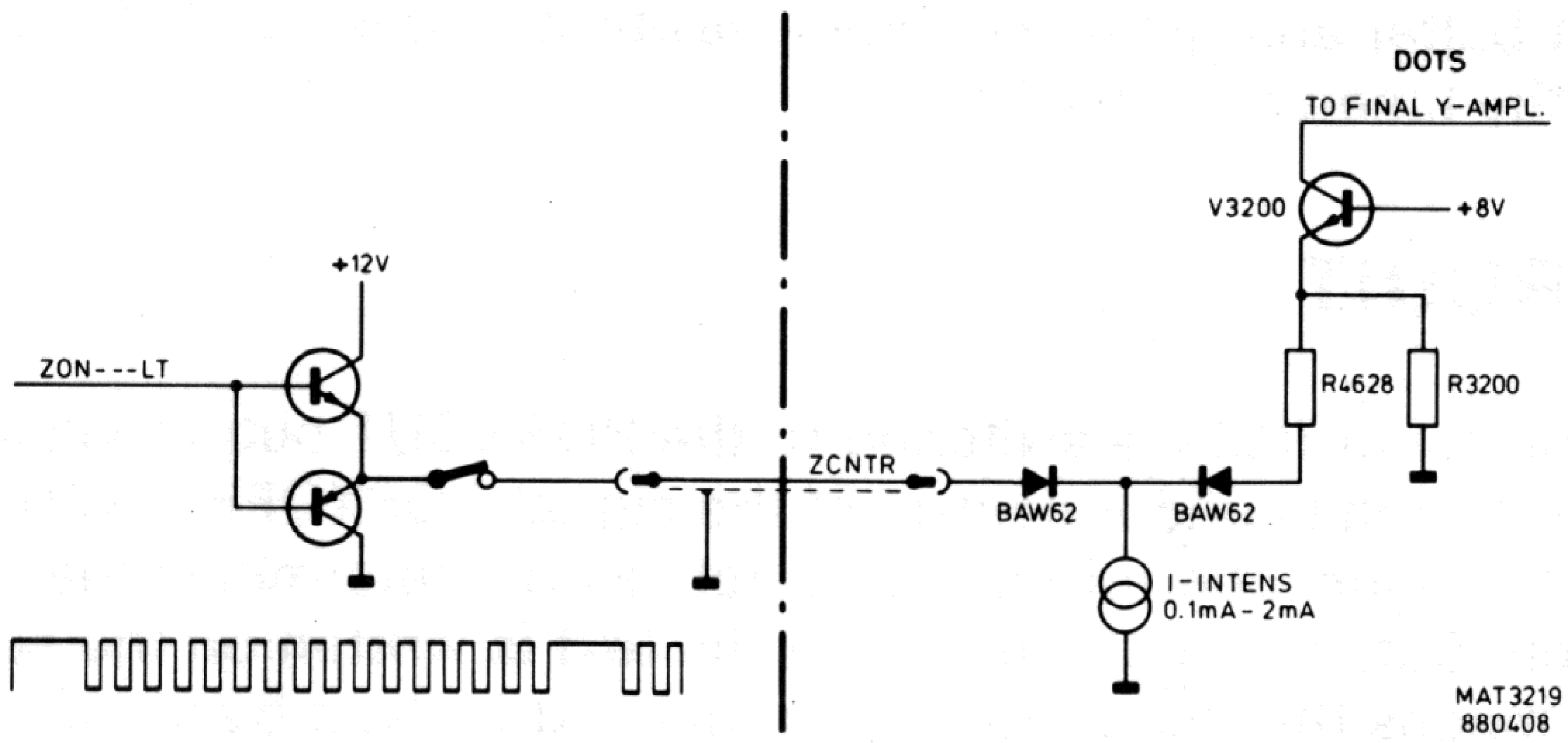


Figure 16.5 Z control for DOTS mode

When dots-joined is selected, the signal PLOT--HT is low and DOTS--LT is high. This means that when the trace is written, the brightness is dimmed, because a part of the current source on unit A4 is floating through resistor R566. During the flyback, signal ZON---LT is high so that the trace is fully blanked. Note that the period between two dots is not blanked now.

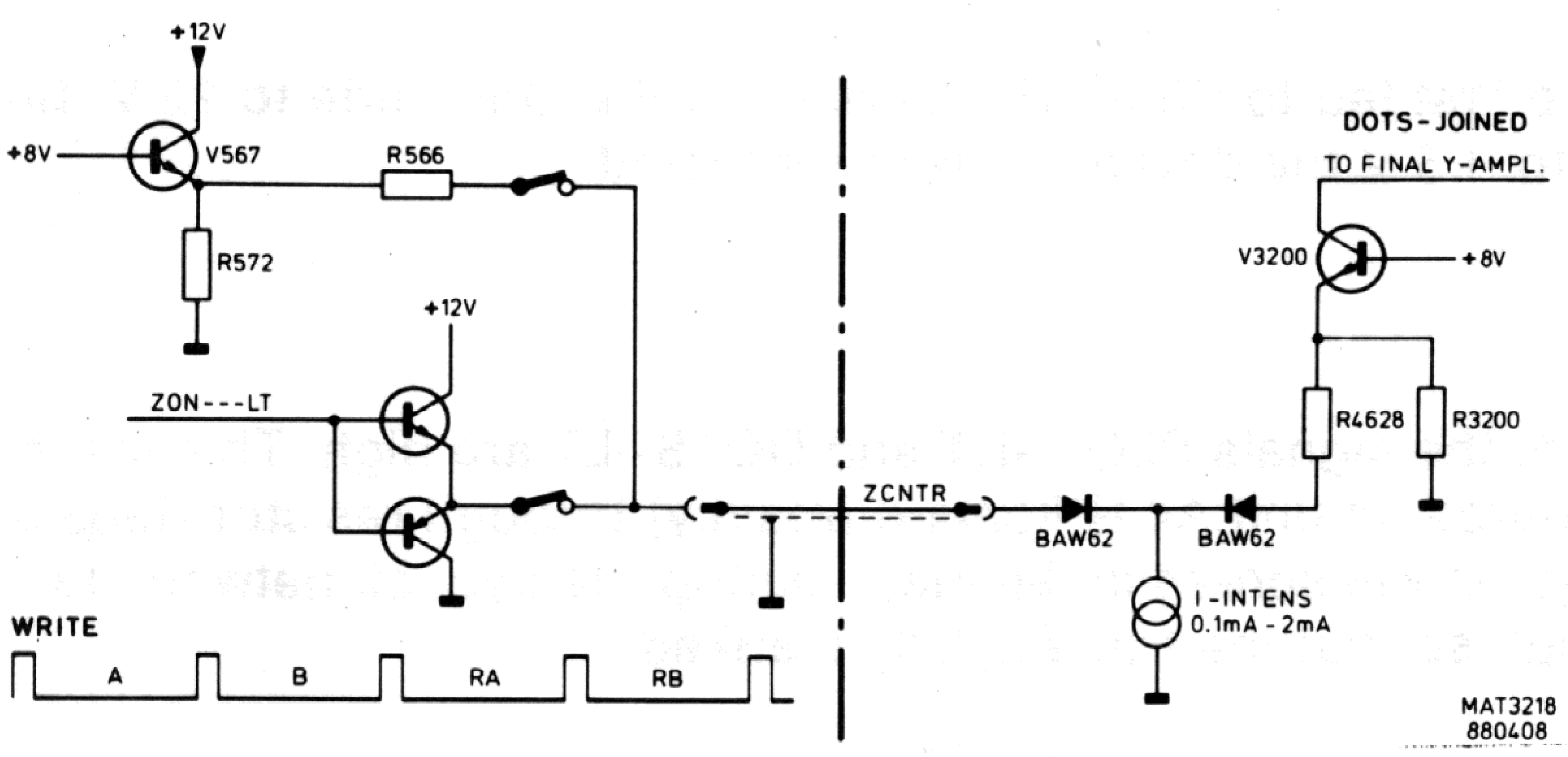


Figure 16.6 Z control for DOTS JOINED mode

16.6 PLOT AND PENLIFT CIRCUIT

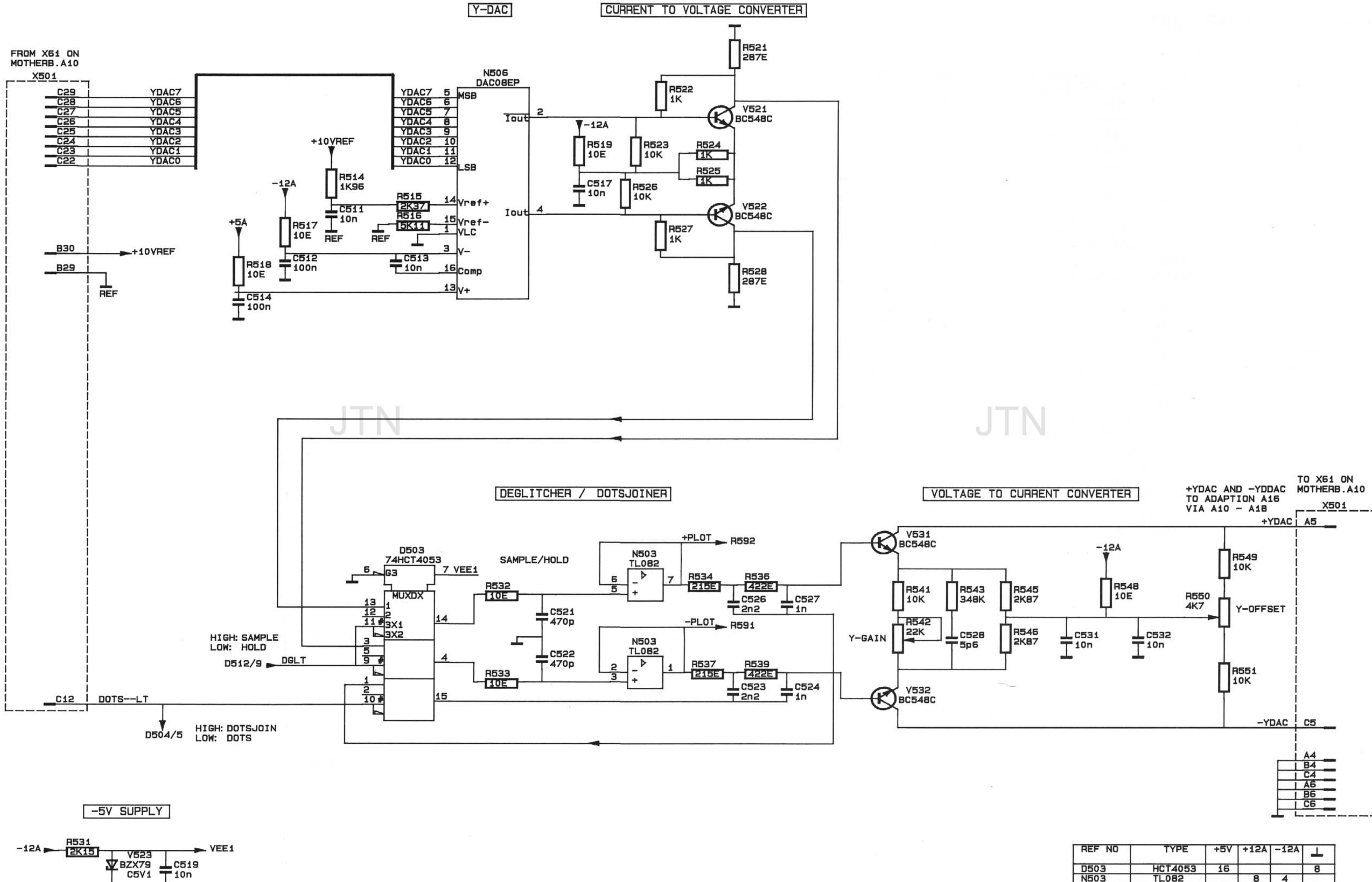
This circuit generates the correct signals for an external plotter. The vertical + PLOT and - PLOT signals are derived from N503 and converted into an asymmetrical signal between 0...1 V by N512. The horizonal X PLOT signal is derived from N513 and also converted into a voltage signal between 0...1 V. Both voltage signals are applied to multiplexer D512. When PLOT--HT is high the signals are fed to the PLOT output socket at the rear of the instrument.

Selectable by the service menu, the PENLIFT signals can be active low or active high. This signal is fed via V611, V612 and V613 and applied as an open-collector output to the PLOT socket.

The signals PLOT--HT and PENLIFT are derived from D313 on the DCL circuit A13.

16.7 SIGNAL NAME LIST

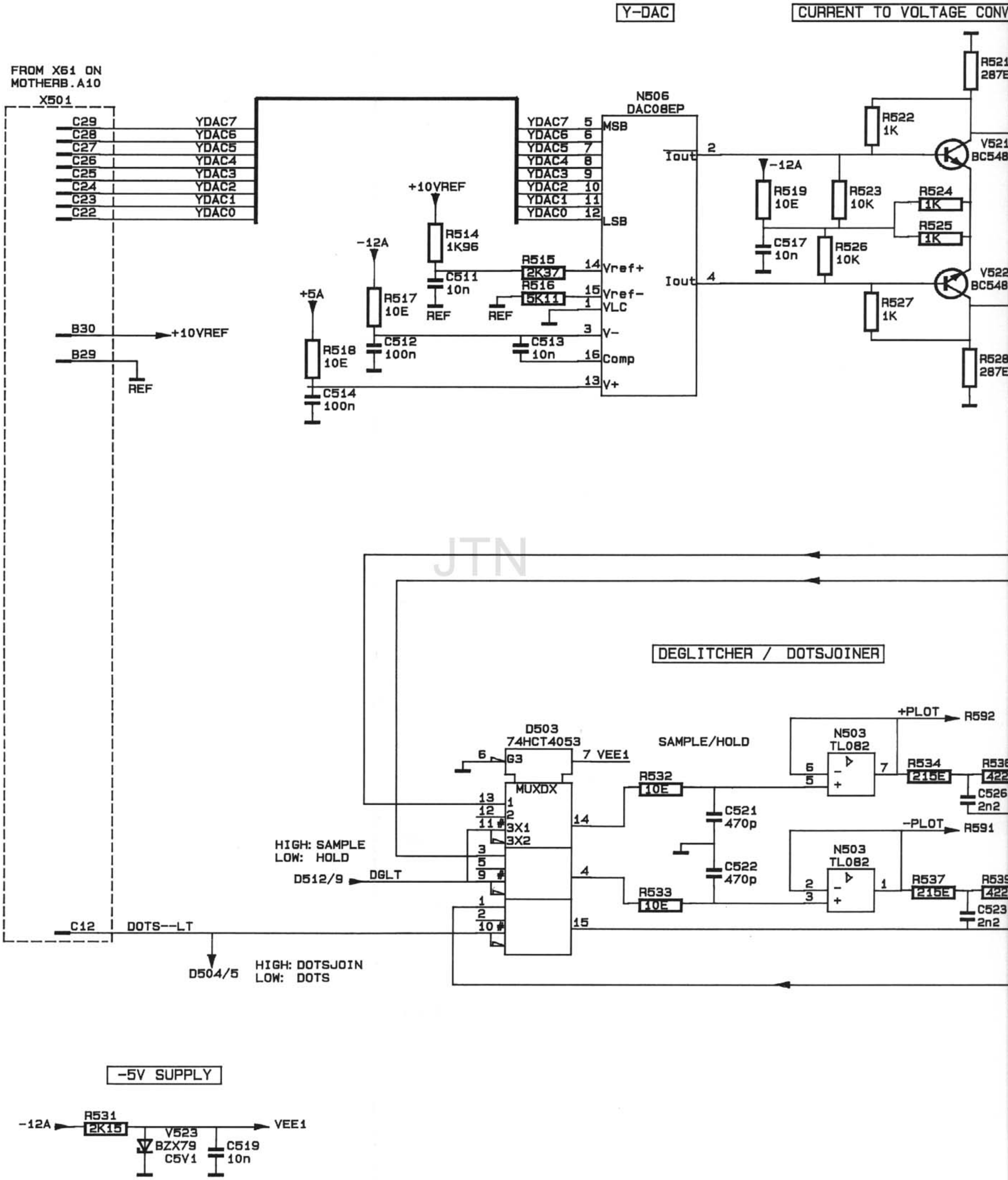
Signal name	Description	Signal source	Signal destination(s)
AD0...7	Data bus from ADC circuit	N505	D412
BATT	Battery voltage	X501/B3	V302
CHAEV	Channel A even	R937	R501
CHAOD	Channel A odd	R927	R502
CHBEV	Channel B even	R957	R508
CHBOD	Channel B odd	R947	R509
CHSEL0	Channel select 0	D411	N505
CHSEL1	Channel select 1	D411	N505
DGLT	Deglitch control	R584	D503 - D512
DSOSWP	Digital storage osc. sweep	N513	V4521
DOTS--LT	Control signal for dot join	D313	D503 - D504 - R596
PENLIFT	Penlift	D313	R614
PLOT--HT	Control signal for plot	D313	D504 - D512
PLOT-X	Plot X	R608	X505/1
PLOT-Y	Plot Y	R611	X505/3
+PLOT	Pos. plot	N503	R592
-PLOT	Neg. plot	N503	R591
POSX	X position	N7003	D113 - R560
POSXOFHT	Position off	D313	V555
POSXOUT	X position out	V554/V557	R4722
SC0--HT	State counter 0	D314	R584
STCONVHT	Start conversion	D411	N505
XDAC0...9	Data bus for X DAC	D311/D312	N507
XPLOT	X plot signal	N513	R587
YDAC0...7	Data bus for Y DAC	D413	N506
+YDAC	Pos. Y DAC out	V531	R1616
-YDAC	Neg. Y DAC out	V532	R1617
ZCNTR	Z control	D505	V4618
ZON---LT	Z on control	D314	D504

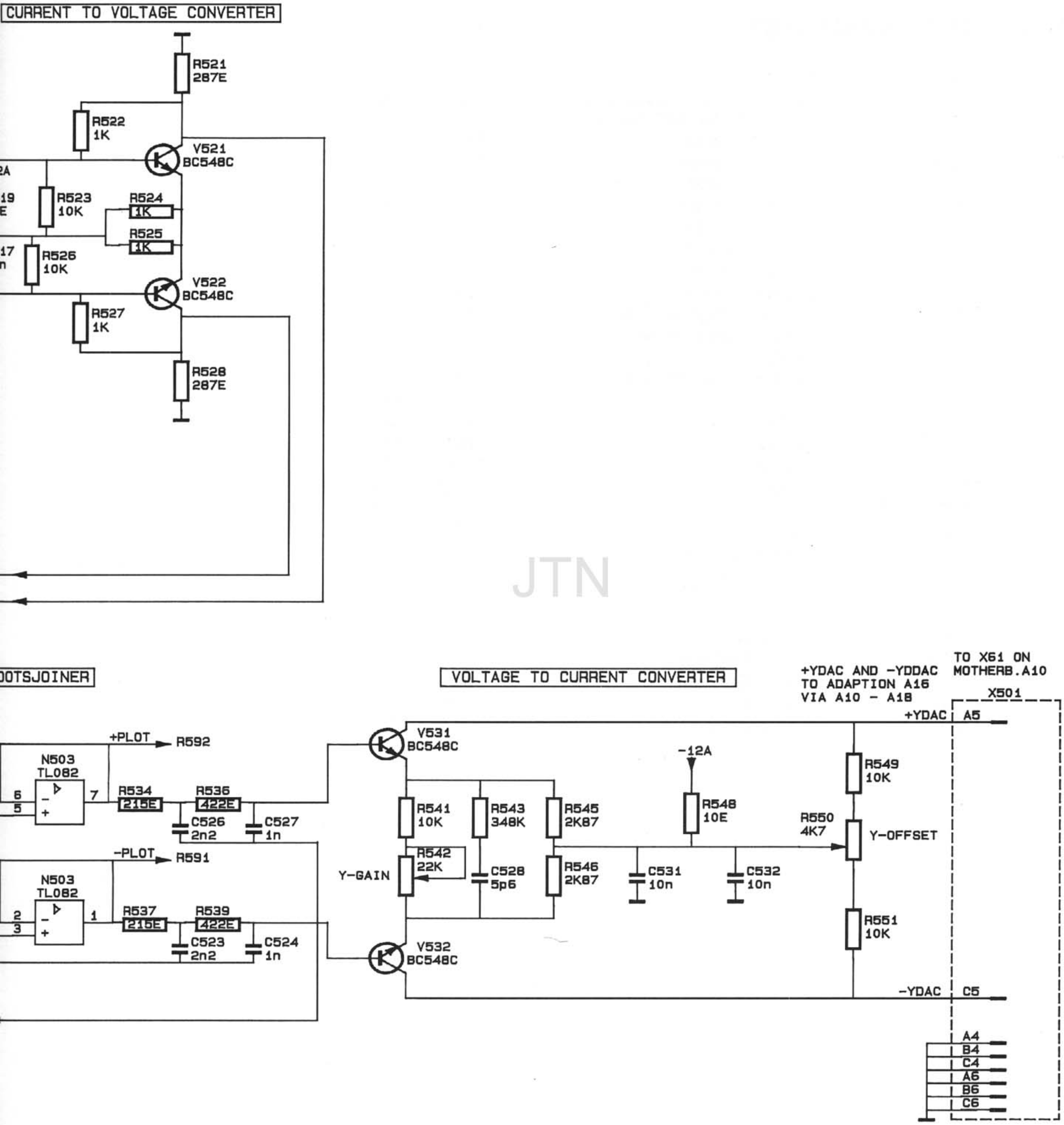


REF NO	TYPE	+5V	+12A	-12A	⊥
D503	HCT4053	16			8
N503	TL082		8	4	
N506	DAC08				

MAT 3573A

Figure 16.7 Circuit diagram of ADC DAC unit: Y DAC circuit


Y-DAC
CURRENT TO VOLTAGE CONV
FROM X61 ON MOTHERB.A10
X501
C29 C28 C27 C26 C25 C24 C23 C22
YDAC7 YDAC6 YDAC5 YDAC4 YDAC3 YDAC2 YDAC1 YDAC0
N506 DAC08EP
MSB LSB Iout Vref+ Vref- VLC V- Comp V+
+10VREF
R514 1K96
-12A
+5A
R515 2K37
R516 5K11
C511 10n
REF
R517 10E
R518 10E
C512 100n
C513 10n
C514 100n
B30 +10VREF
B29 REF
R519 10E
R523 10K
R524 1K
R525 1K
C517 10n
R526 10K
R522 1K
R527 1K
R521 287E
R528 287E
V521 BC548
V522 BC548
JTN
DEGLITCHER / DOTSJOINER
D503 74HCT4053
G3 7 VEE1
MUXDX
SAMPLE/HOLD
N503 TL082
+PLOT R592
-PLOT R591
R532 10E
R533 10E
C521 470p
C522 470p
R534 215E
R537 215E
C526 2n2
C523 2n2
HIGH: SAMPLE
LOW: HOLD
D512/9 DGLT
C12 DOTS--LT
D504/5
HIGH: DOTSJOIN
LOW: DOTS
-5V SUPPLY
-12A
R531 2K15
V523 BZX79 C5V1
C519 10n
VEE1



REF NO	TYPE	+5V	+12A	-12A	⊥
D503	HCT4053	16			8
N503	TL082		8	4	
N506	DAC08				

MAT 3573A

Figure 16.7 Circuit diagram of ADC DAC unit: Y DAC circuit

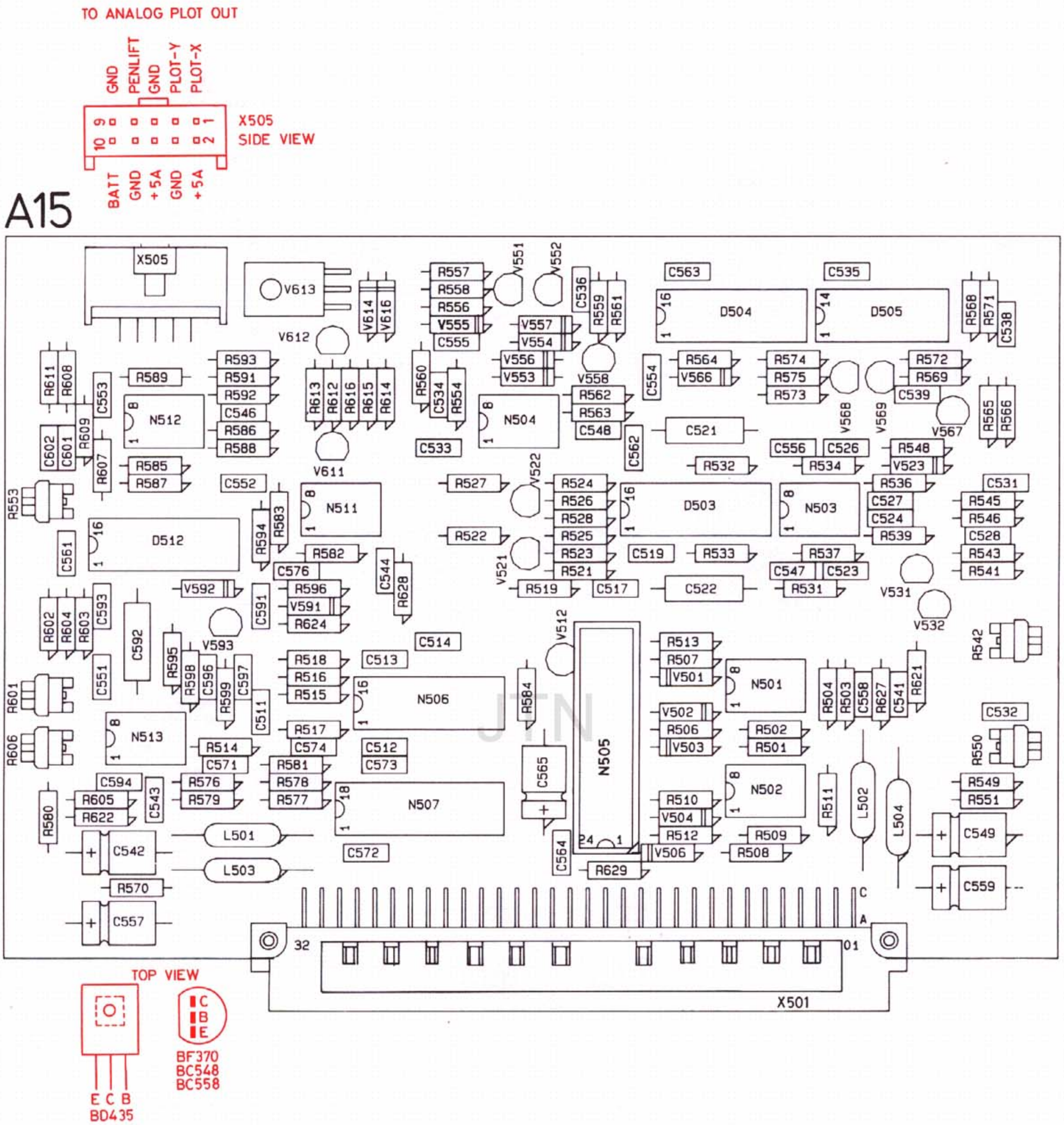
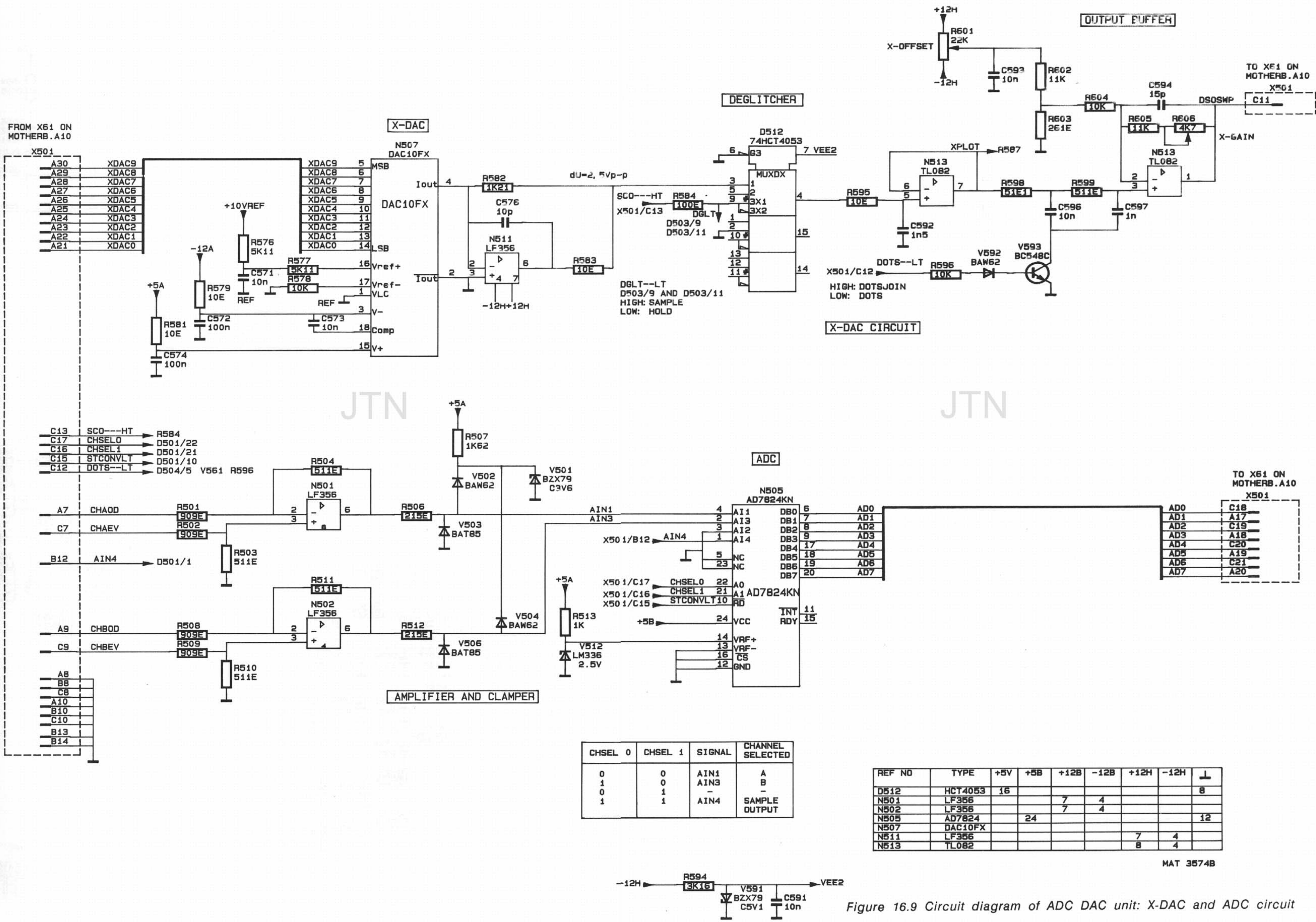


Figure 16.8 ADC DAC unit p.c.b.

MAT3576A

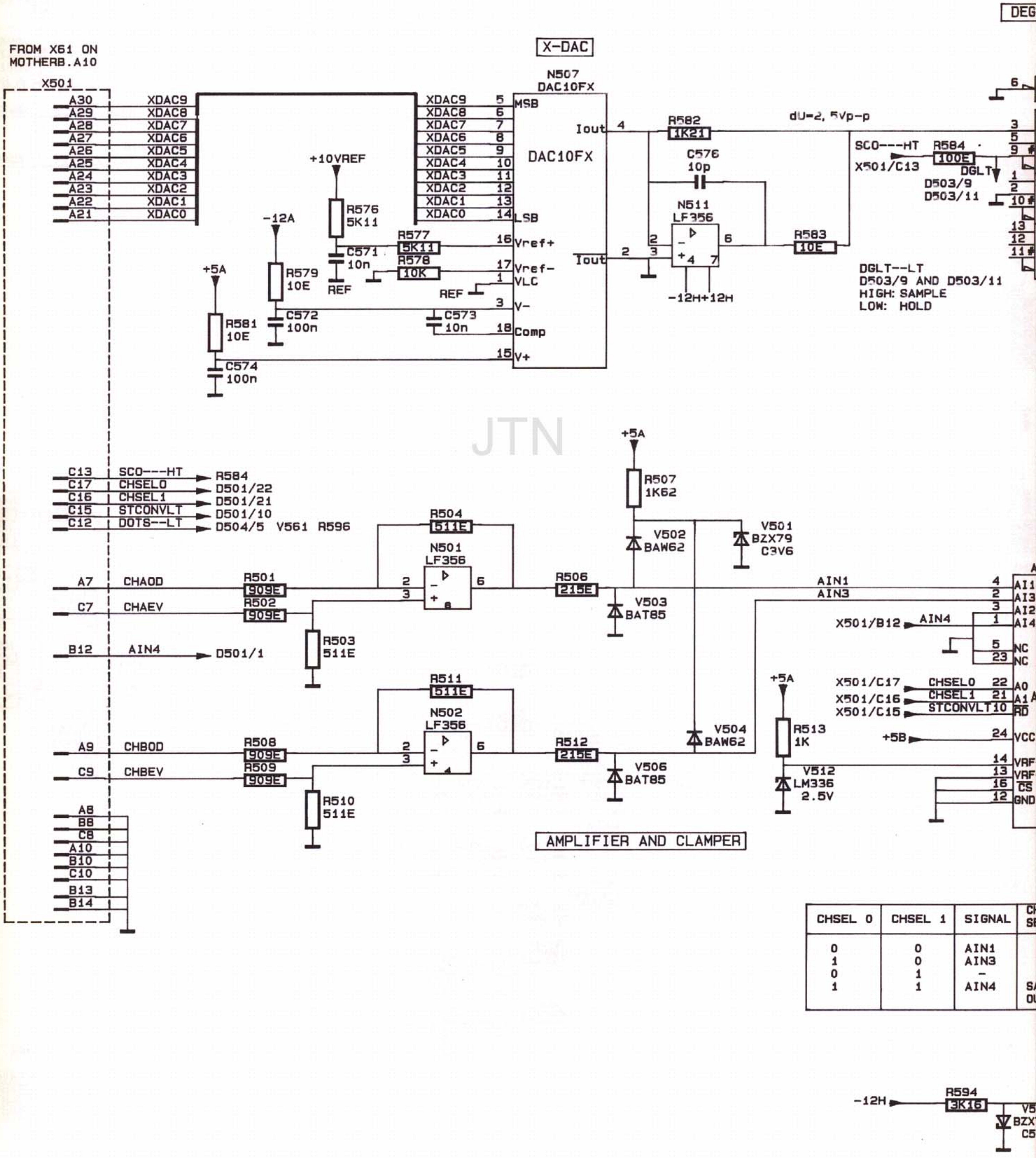


CHSEL 0	CHSEL 1	SIGNAL	CHANNEL SELECTED
0	0	AIN1	A
1	0	AIN3	B
0	1	–	–
1	1	AIN4	SAMPLE OUTPUT

REF NO	TYPE	+5V	+5B	+12B	-12B	+12H	-12H	⊥
D512	HCT4053	16						8
N501	LF356			7	4			
N502	LF356			7	4			
N505	AD7824		24					12
N507	DAC10FX							
N511	LF356					7	4	
N513	TL082					8	4	

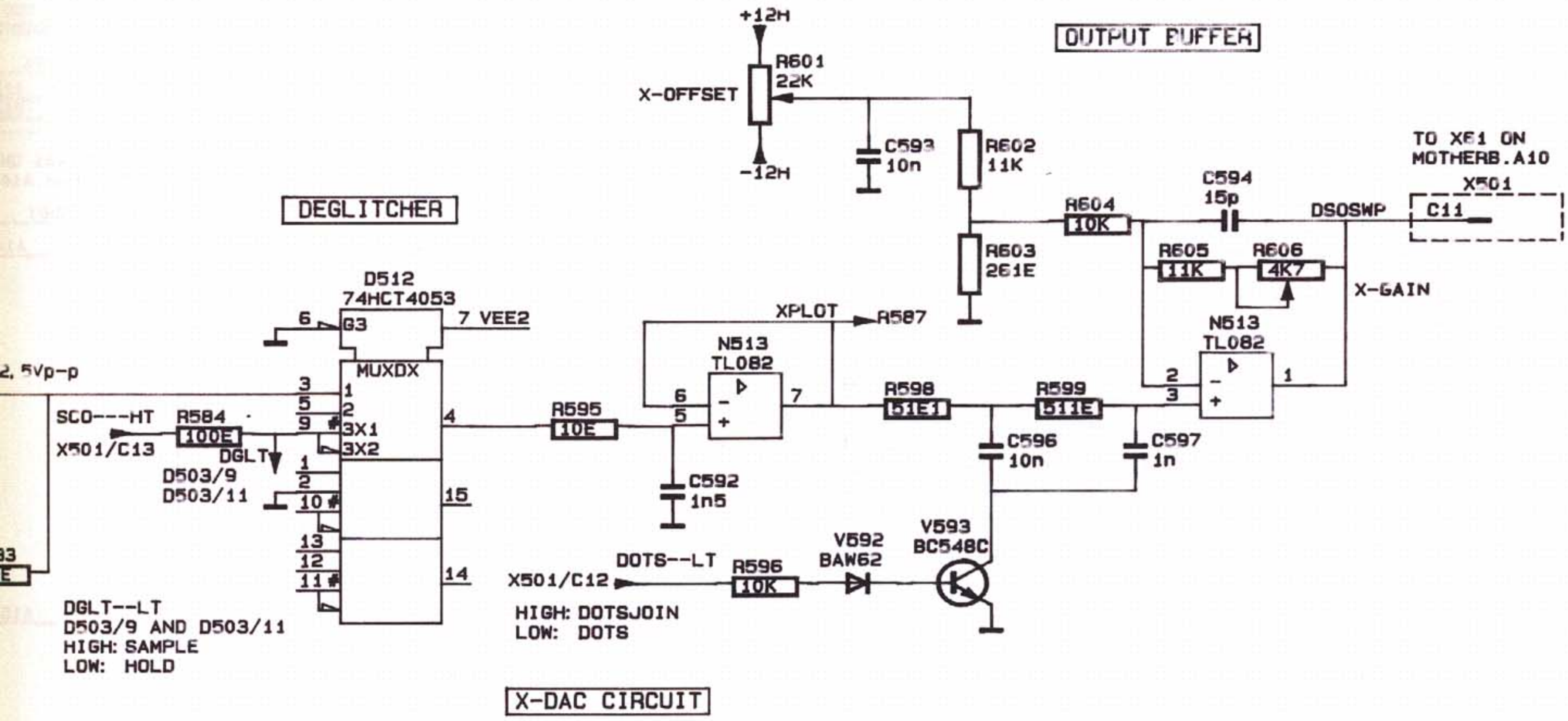
MAT 3574B

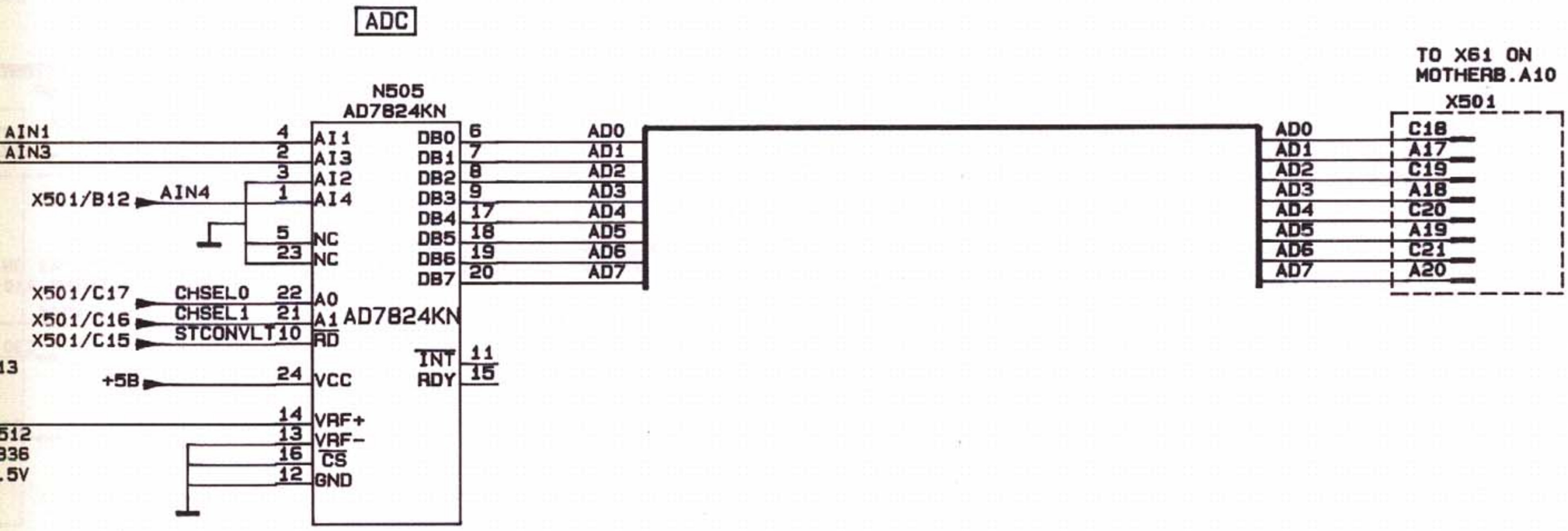
Figure 16.9 Circuit diagram of ADC DAC unit: X-DAC and ADC circuit



CHSEL 0	CHSEL 1	SIGNAL	CH SE
0	0	AIN1	
1	0	AIN3	
0	1	-	
1	1	AIN4	SA OU

JTN





CHSEL 0	CHSEL 1	SIGNAL	CHANNEL SELECTED
0	0	AIN1	A
1	0	AIN3	B
0	1	–	–
1	1	AIN4	SAMPLE OUTPUT

REF NO	TYPE	+5V	+5B	+12B	-12B	+12H	-12H	⊥
D512	HCT4053	16						8
N501	LF356			7	4			
N502	LF356			7	4			
N505	AD7824		24					12
N507	DAC10FX							
N511	LF356					7	4	
N513	TL082					8	4	

MAT 3574B

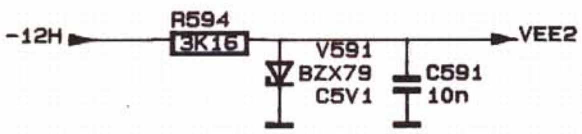


Figure 16.9 Circuit diagram of ADC DAC unit: X-DAC and ADC circuit

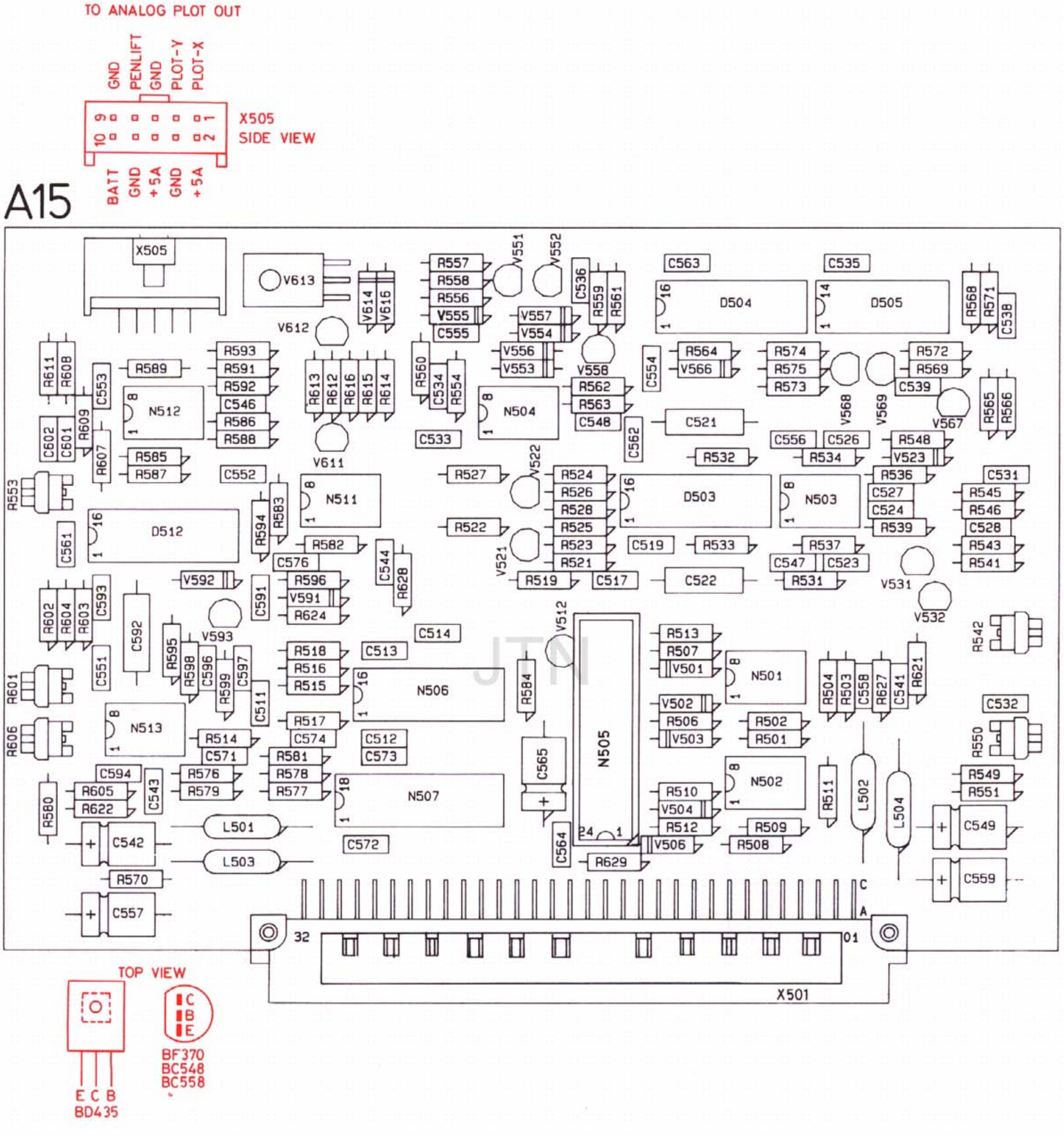
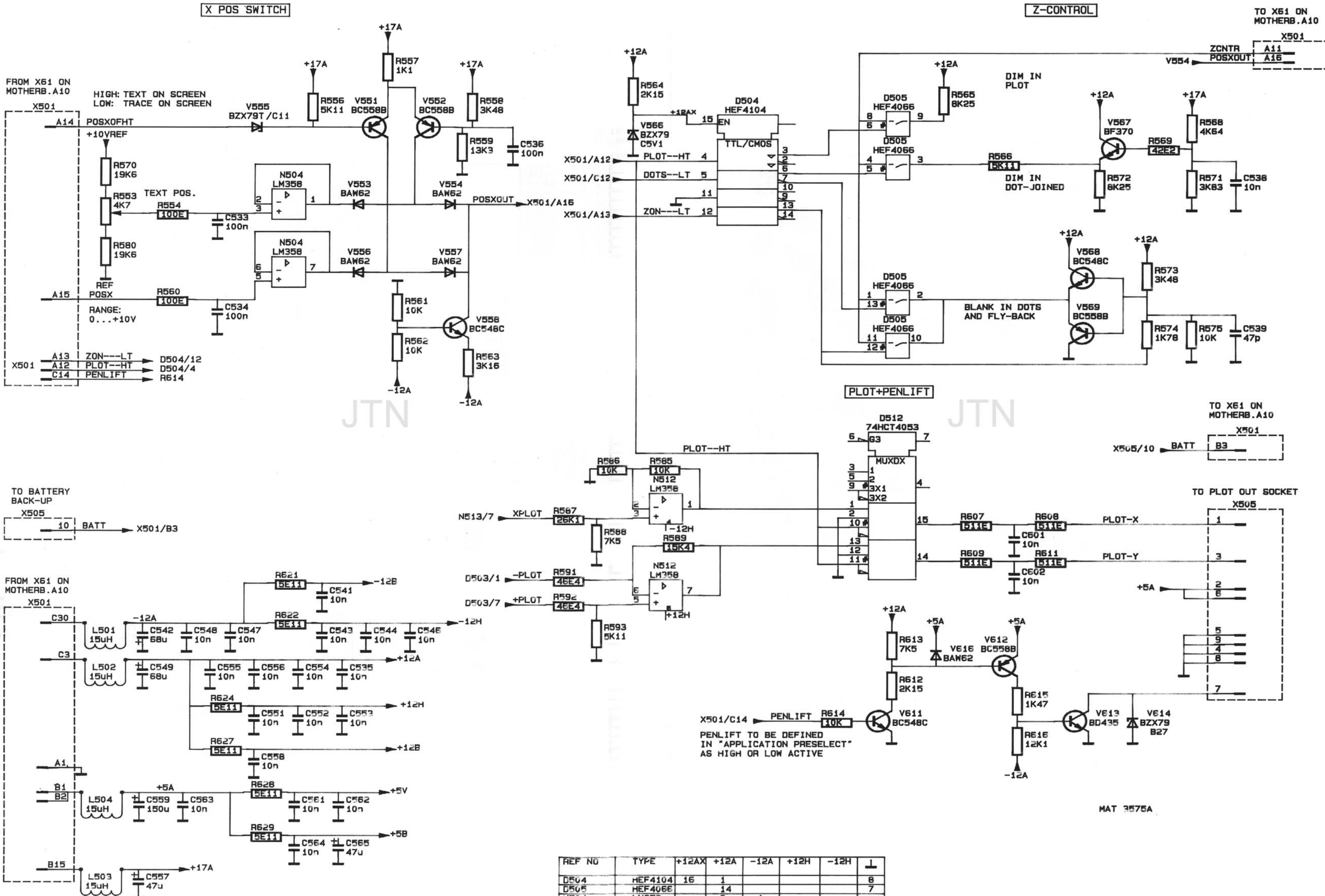


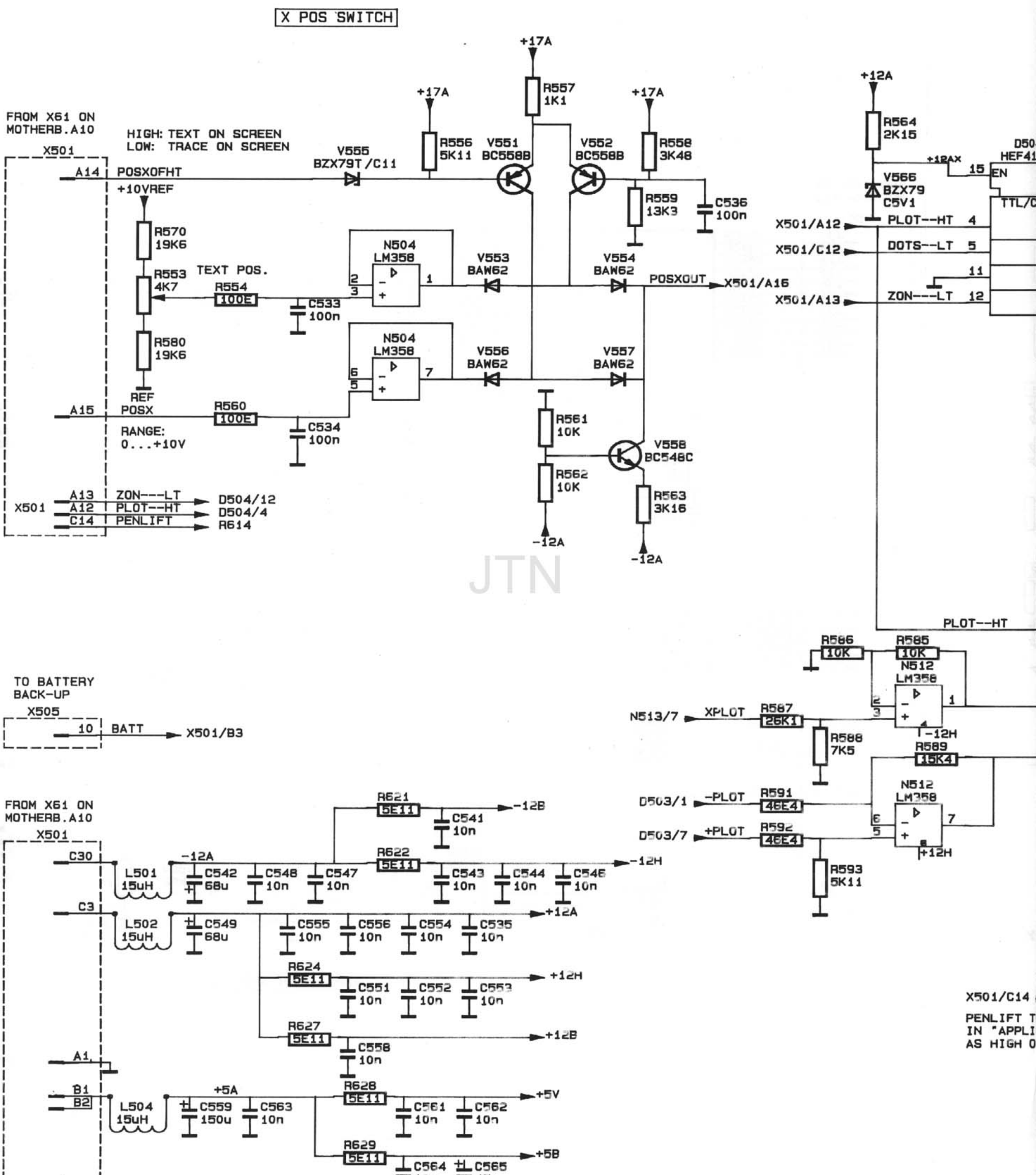
Figure 16.10 ADC DAC unit p.c.b.

MAT3576A



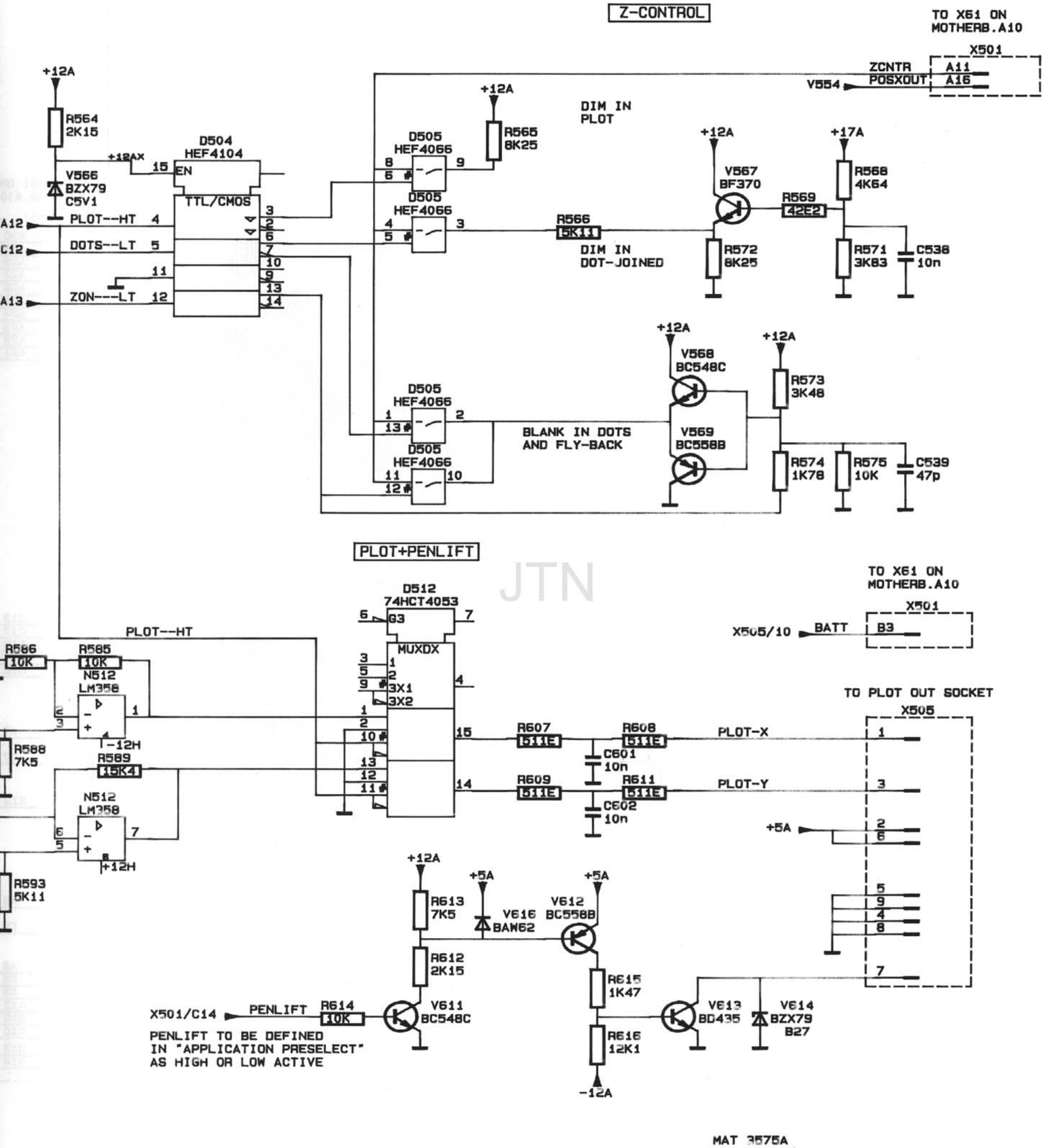
REF NO	TYPE	+12AX	+12A	-12A	+12H	-12H	⊥
D504	HEF4104	16	1				8
D505	HEF4066		14				7
N504	LM358		8	4			
N512	LM358				8	4	

Figure 16.11 Circuit diagram of ADC DAC unit: part 3



REF NO	TYPE	+12AX	+12A
D504	HEF4104	16	1
D505	HEF4066		14
N504	LM358		8
N512	LM358		

Fig



0	TYPE	+12AX	+12A	−12A	+12H	−12H	⊥
	HEF4104	16	1				8
	HEF4066		14				7
	LM358		8	4			
	LM358				8	4	

Figure 16.11 Circuit diagram of ADC DAC unit: part 3

17 ADAPTATION UNIT (A16)

17.1 VERTICAL DISPLAY MODE SWITCH

The adaptation unit consists of diode switches. Depending on the selection of real-time mode or digital memory mode, the current signals of channels A and B are applied via the so-called "analogue signal path" or the so-called "digital signal path".
The diode switches are under control of the signals SHAR and SHARN.
The selection table is as follows:

signal	real-time mode	digital memory mode
MEMON-HT	LOW	HIGH
SHAR	-12 V	+12 V
SHARN	+12 V	-12 V

17.2 REAL TIME MODE AMPLIFIER

Selection of the analog signals path means that the current signals of channels A and B are directly coupled to the inputs of the analog vertical channel switch D601 via diodes V609, V611, V612 and V613. The two devices D601 and D602 are connected in parallel and have the following switch selections:

	D601		D602	
	pin 10	pin 11	pin 10	pin 11
A	1	0	0	0
B	0	1	0	0
TRIG LEVEL VIEW	0	0	1	0
ADD	1	1	0	0
DIGITAL	0	0	0	1

Furthermore all possible 2, 3 or 4 channel combinations are possible in alternated and chopped display (see also section 5.4).

The stage comprises the following real-time functions:

- Channel B normal/invert (HIGH is invert) on D601-7.
  (The balance between normal/invert can be adjusted with R2212, see section 5.1)
- Trigger view invert (HIGH is invert) on D602-2.

The output is applied to the delay line driver on unit A2.

Channel A position control is obtained via long-tailed pair amplifier V626 and V627. This circuit is sourced by current source V628 and driven by N601. The channel B position control is identical but also includes a multiplexer D603 for normal/invert function.

17.3 DIGITAL MEMORY AMPLIFIER

Selection of the digital signal path means that the current signals of channels A and B are coupled to the common-base amplifier V616, V617, V621 and V622.
Because of the +12 V level of SHAR these transistors conduct and the currents are routed to the output. The output currents are applied to the P^2CCD unit A18.

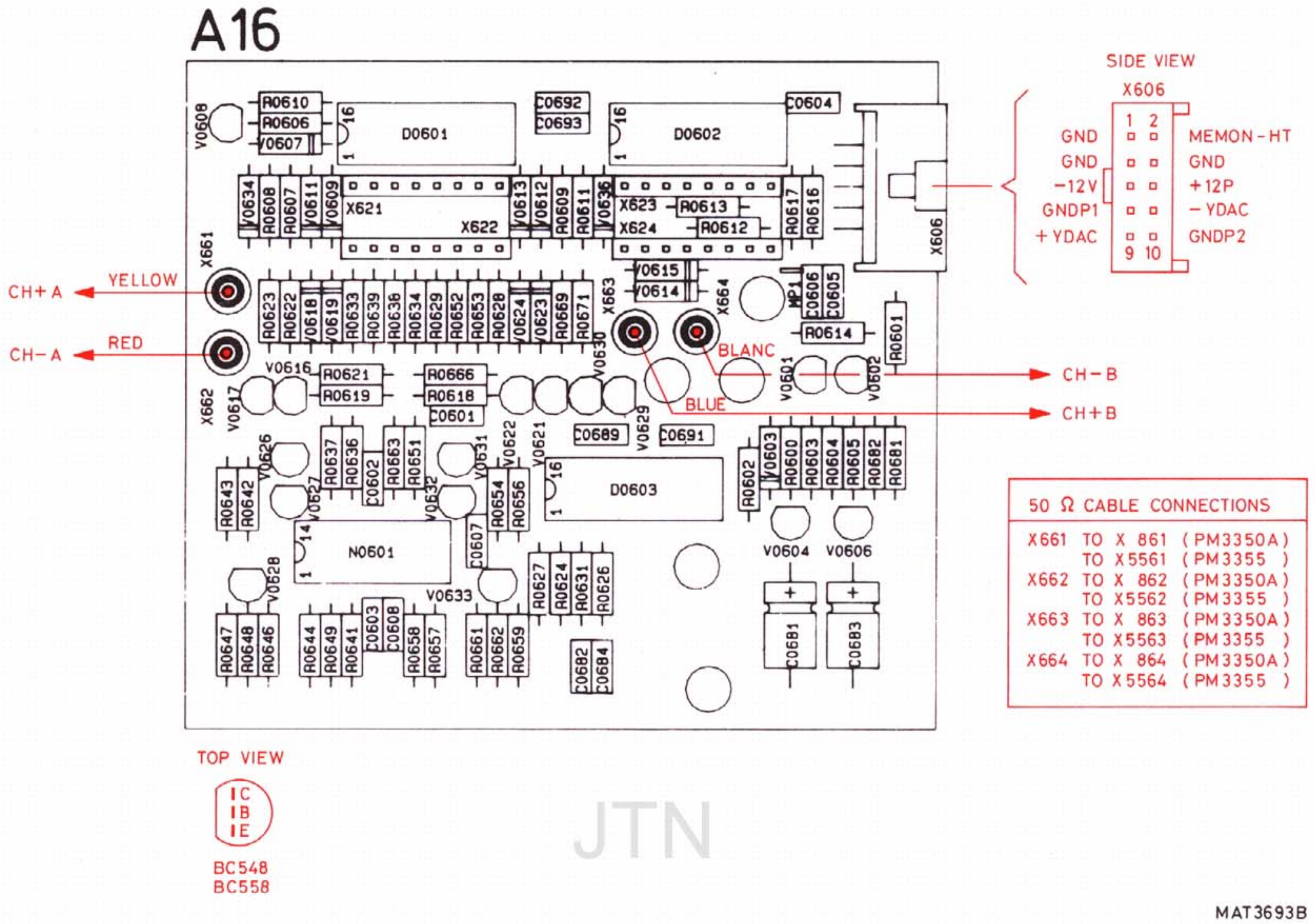
The position controls for both channels are determined by the same circuit as for the real-time path.

Next, MEMON-HT also causes the selection of the vertical current signals -YDAC and +YDAC. These signals are now routed to the delay- line driver via D602 on unit A2. Note that the DLD1 and DLD2 outputs are only interconnected on A2 (see also figure 5.1).

In digital memory mode, selection can be made for trigger level view by applying a high level to D602-10. This d.c. signal is received from the trigger level view pre-amplifier on unit A2.

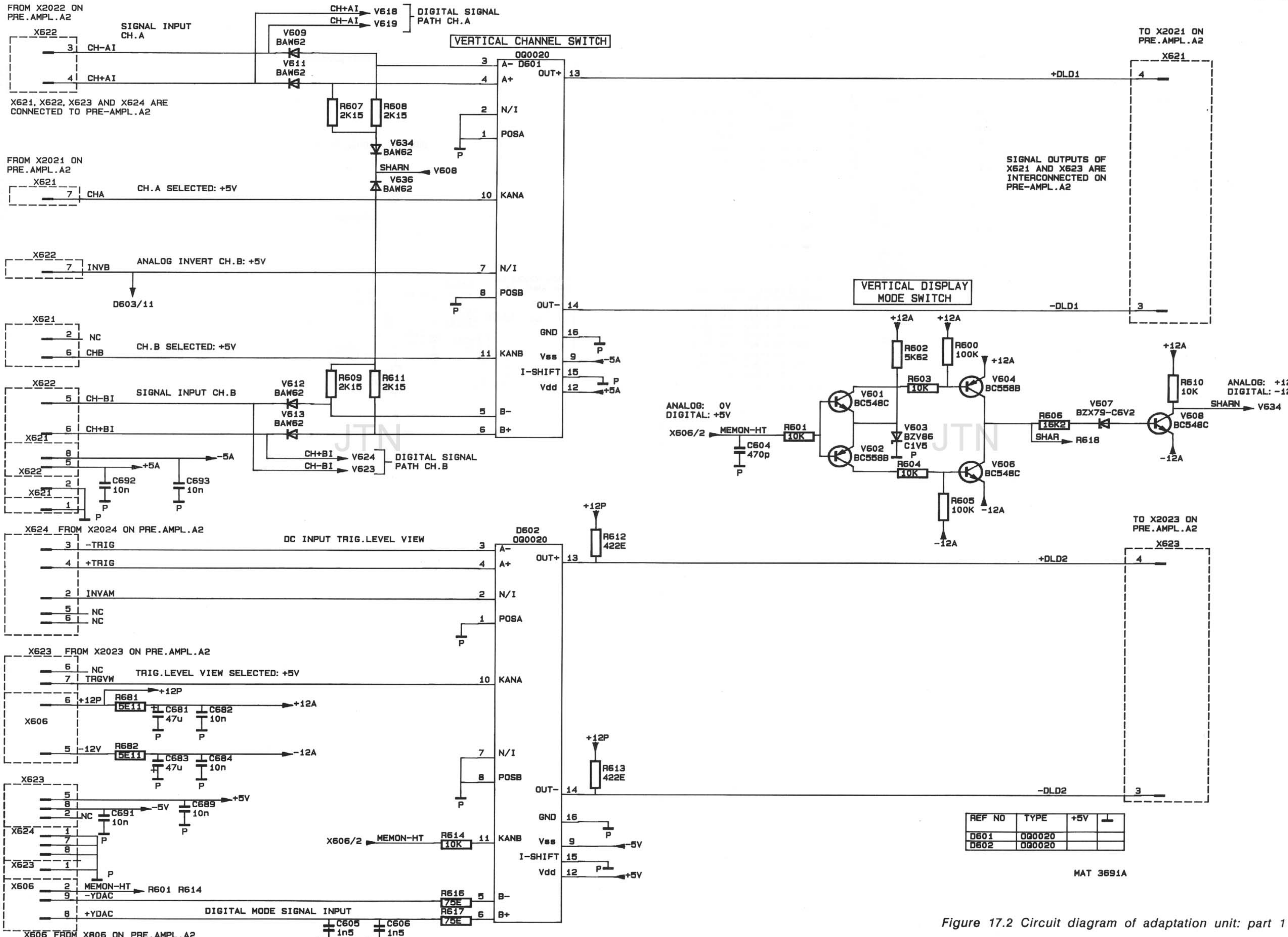
17.4 SIGNAL NAME LIST

Signal name	Description	Signal source	Signal destination(s)
CHA	Channel A selection	D2603	D601
CH+A	Channel +A output	V616	R702
CH-A	Channel - A output	V617	R707
CH+AI	Channel +A input	D2002	V611 - V618 - R638
CH-AI	Channel - A input	D2002	V609 - V619 - R639
CHB	Channel B selection	D2603	D601
CH+B	Channel +B output	V622	R702
CH-B	channel - B output	V621	R701
CH+AI	Channel +B input	D2102	V613 - V624 - R653
CH-AI	Channel - B input	D2102	V612 - V623 - R652
DLD1	Delay line driver ch A	D601	D2203
DLD2	Delay line driver ch B	D602	D2203
INVAM	Invert ch A	D2602	D602
INVB	Invert ch B	D2602	D601 - D603
MEMON-HT	Memory on	D222	R601
POS A	Position ch A	R2200	R634
POS B	Position ch B	R2220	R629
+TRIG	+ Trigger	R2404	D602
-TRIG	- Trigger	R2412	D602
TRGVW	Trigger view	D2603	D602
SHAR	Store hardware	V604/V606	V614 - V615
SHARN	Store hardware not	V608	V634 - V635
+YDAC	+ Y DAC signal	V531	R617
-YDAC	- Y DAC signal	V532	R616



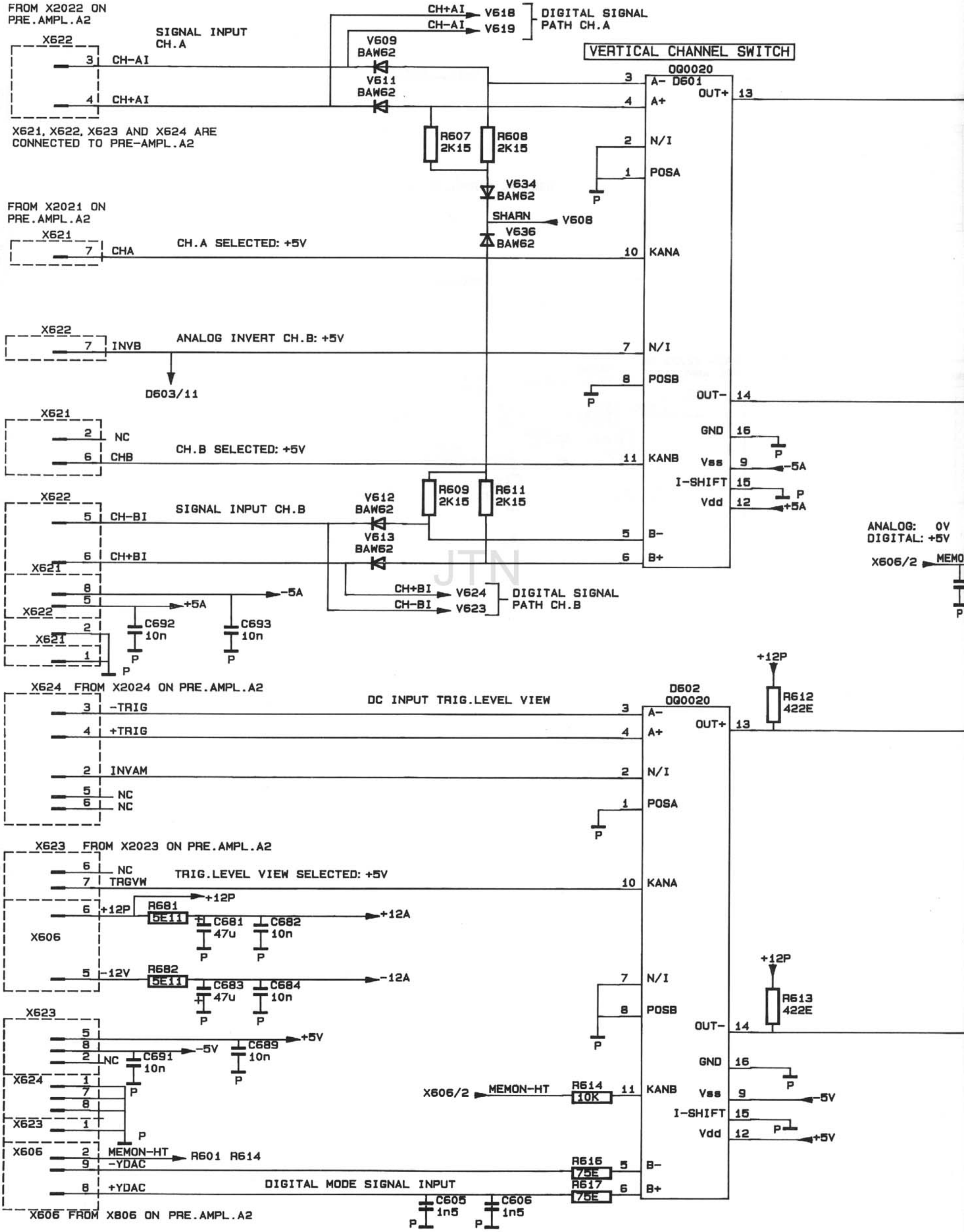
50 Ω CABLE CONNECTIONS			
X661	TO	X 861	(PM3350A)
	TO	X5561	(PM3355)
X662	TO	X 862	(PM3350A)
	TO	X5562	(PM3355)
X663	TO	X 863	(PM3350A)
	TO	X5563	(PM3355)
X664	TO	X 864	(PM3350A)
	TO	X5564	(PM3355)

Figure 17.1 Adaptation unit p.c.b.

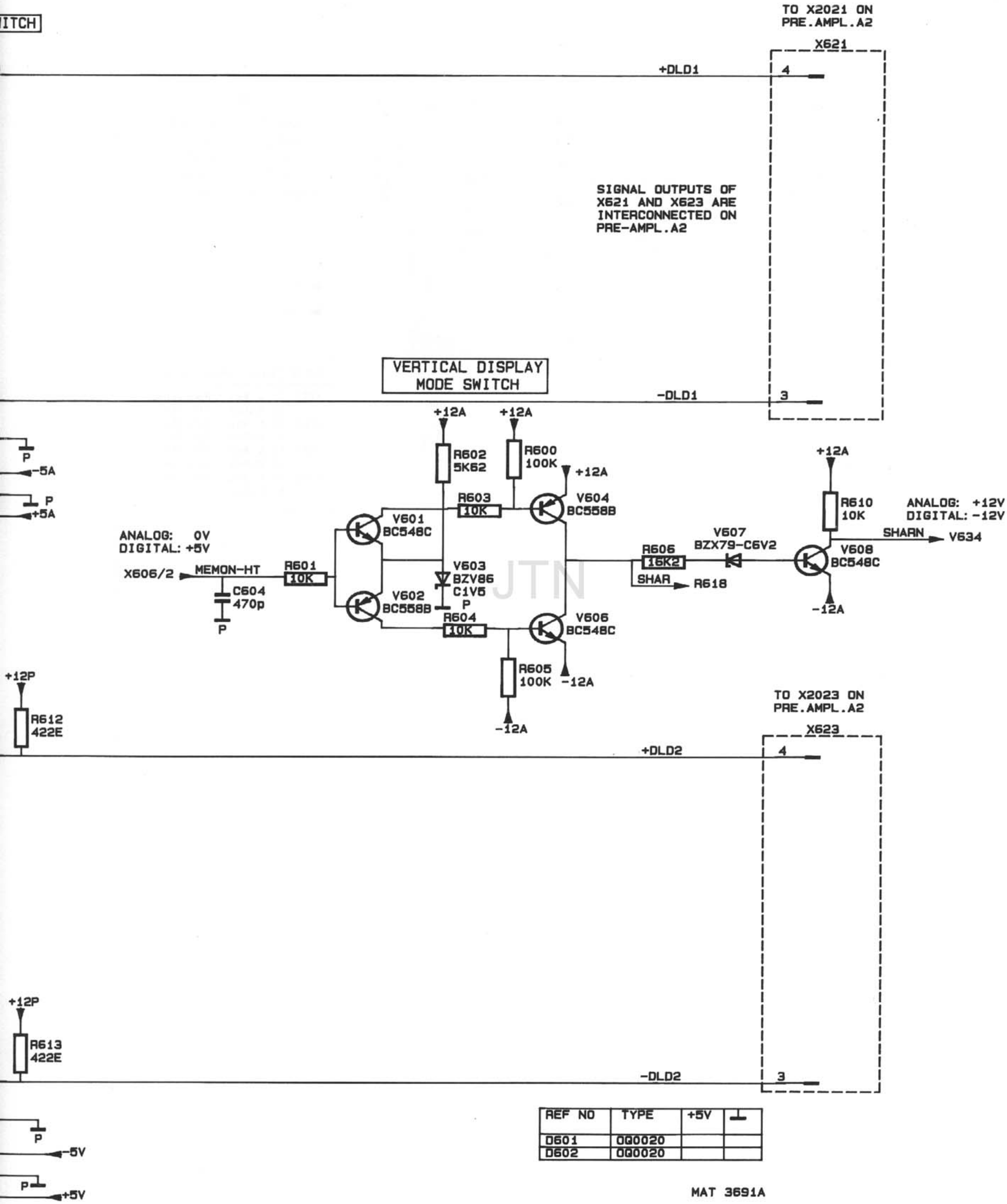


REF NO	TYPE	+5V	⊥
D601	0Q0020		
D602	0Q0020		

Figure 17.2 Circuit diagram of adaptation unit: part 1

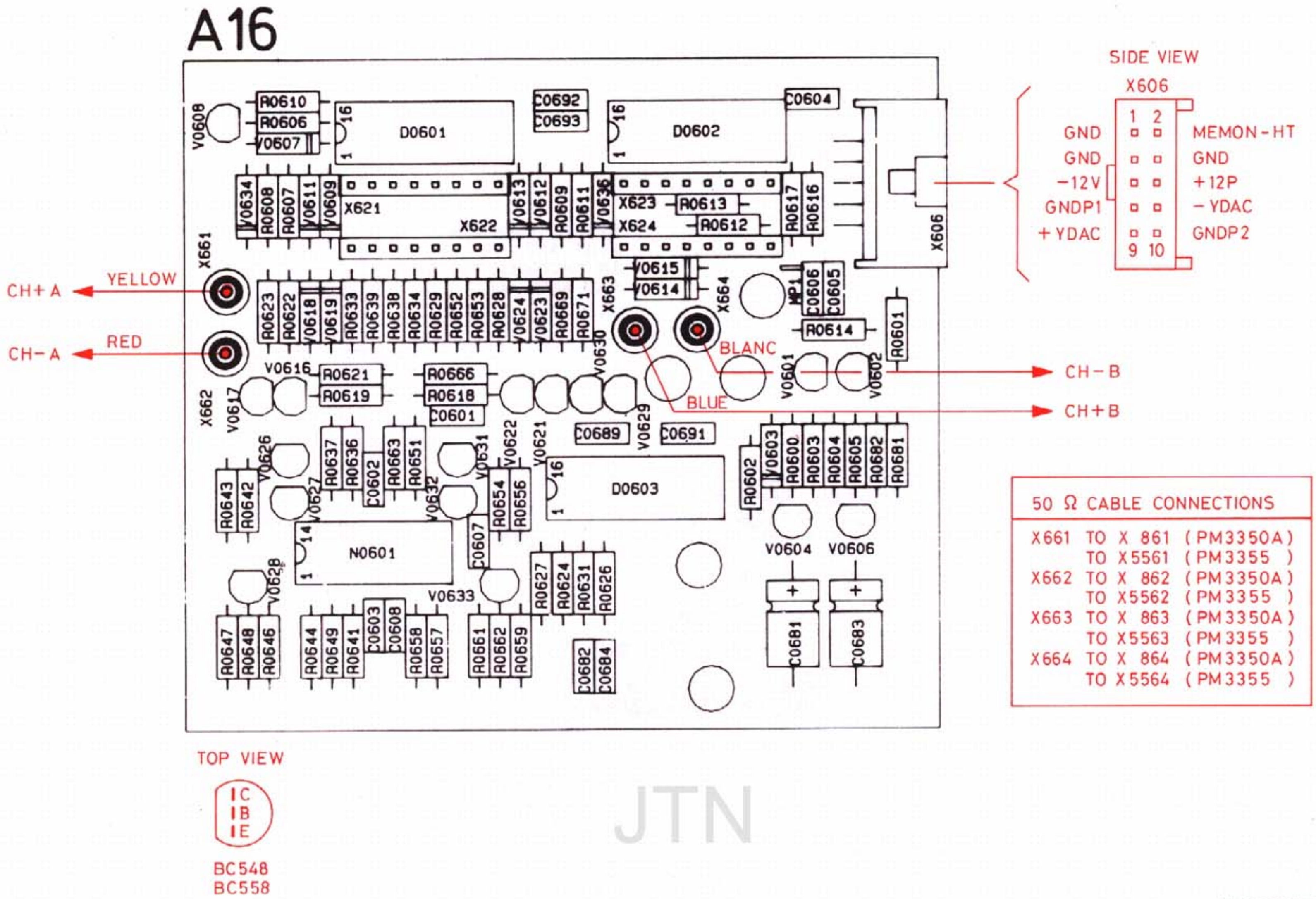


FROM X2022 ON PRE.AMPL.A2
X622
SIGNAL INPUT CH.A
CH-AI
CH+AI
V618
V619
DIGITAL SIGNAL PATH CH.A
VERTICAL CHANNEL SWITCH
V609 BAW62
V611 BAW62
0Q0020
D601
A-
A+
OUT+
N/I
POSA
X621, X622, X623 AND X624 ARE CONNECTED TO PRE-AMPL.A2
R607 2K15
R608 2K15
V634 BAW62
SHARN
V608
V636 BAW62
FROM X2021 ON PRE.AMPL.A2
X621
CHA
CH.A SELECTED: +5V
KANA
ANALOG INVERT CH.B: +5V
INVB
D603/11
POSB
OUT-
NC
CH.B SELECTED: +5V
CHB
KANB
GND
Vss
I-SHIFT
Vdd
SIGNAL INPUT CH.B
CH-BI
CH+BI
V612 BAW62
V613 BAW62
R609 2K15
R611 2K15
B-
B+
ANALOG: 0V
DIGITAL: +5V
X606/2
MEMO
CH+BI
CH-BI
V624
V623
DIGITAL SIGNAL PATH CH.B
-5A
+5A
C692 10n
C693 10n
X624 FROM X2024 ON PRE.AMPL.A2
DC INPUT TRIG.LEVEL VIEW
-TRIG
+TRIG
INVAM
D602
0Q0020
+12P
R612 422E
X623 FROM X2023 ON PRE.AMPL.A2
TRIG.LEVEL VIEW SELECTED: +5V
TRGVW
X606
+12P
R681 5E11
C681 47u
C682 10n
+12A
-12V
R682 5E11
C683 47u
C684 10n
-12A
R613 422E
+5V
-5V
C691 10n
C689 10n
MEMON-HT
R614 10K
-5V
+5V
R601 R614
-YDAC
+YDAC
DIGITAL MODE SIGNAL INPUT
R616 75E
R617 75E
C605 1n5
C606 1n5
X606 FROM X806 ON PRE.AMPL.A2



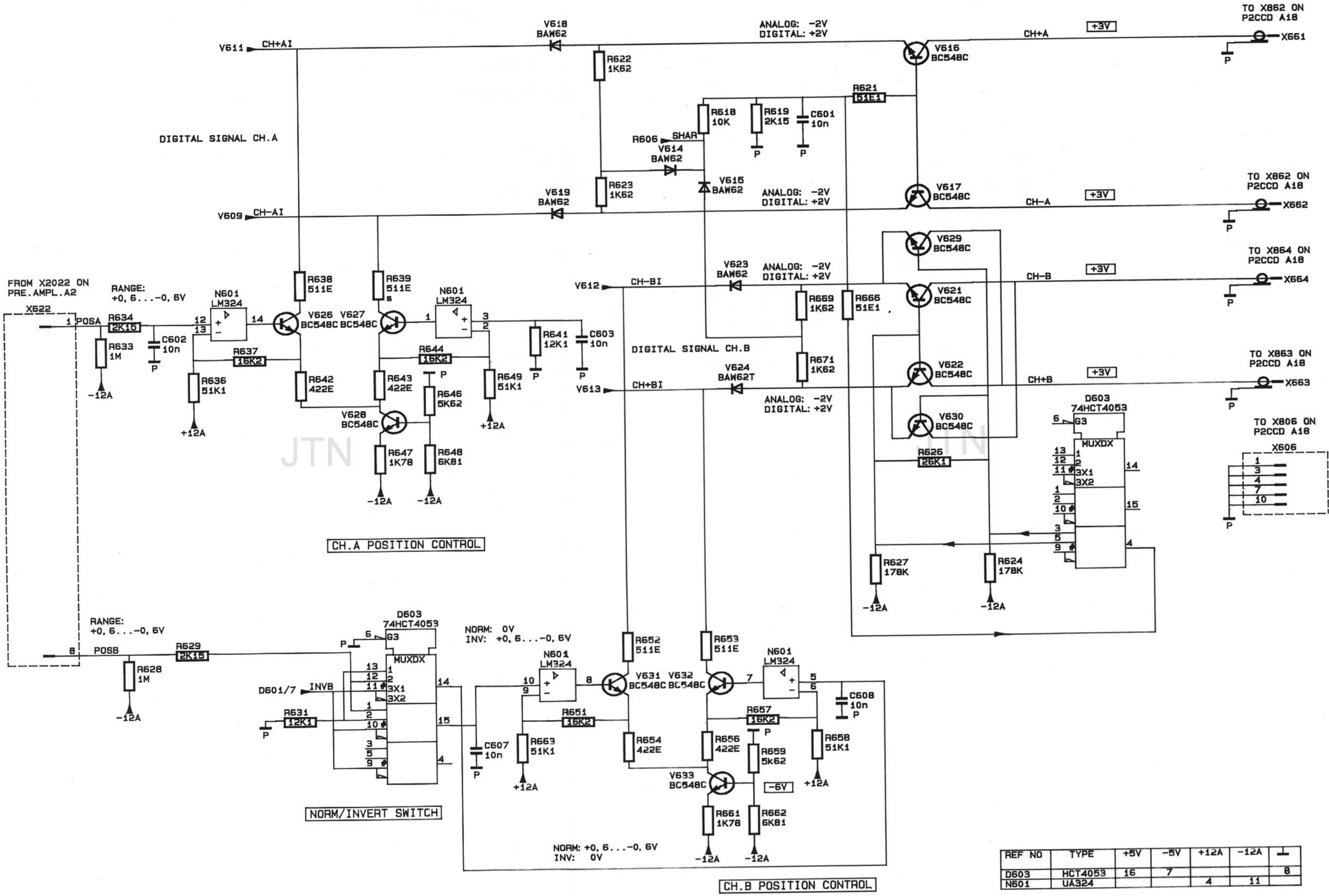
REF NO	TYPE	+5V	⊥
D601	OQ0020		
D602	OQ0020		

Figure 17.2 Circuit diagram of adaptation unit: part 1



50 Ω CABLE CONNECTIONS
X661 TO X 861 (PM3350A)
TO X5561 (PM3355)
X662 TO X 862 (PM3350A)
TO X5562 (PM3355)
X663 TO X 863 (PM3350A)
TO X5563 (PM3355)
X664 TO X 864 (PM3350A)
TO X5564 (PM3355)

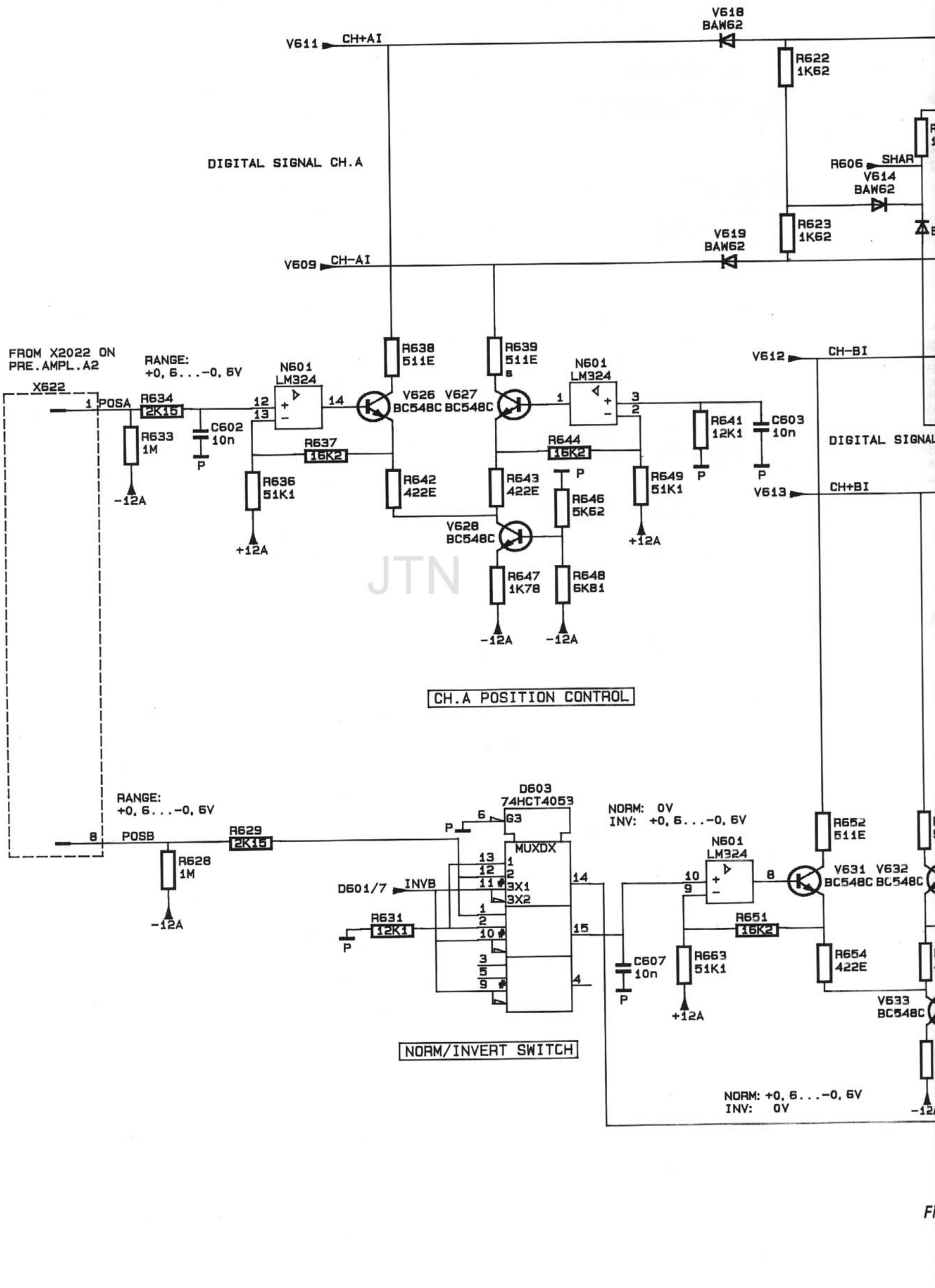
Figure 17.3 Adaptation unit p.c.b.

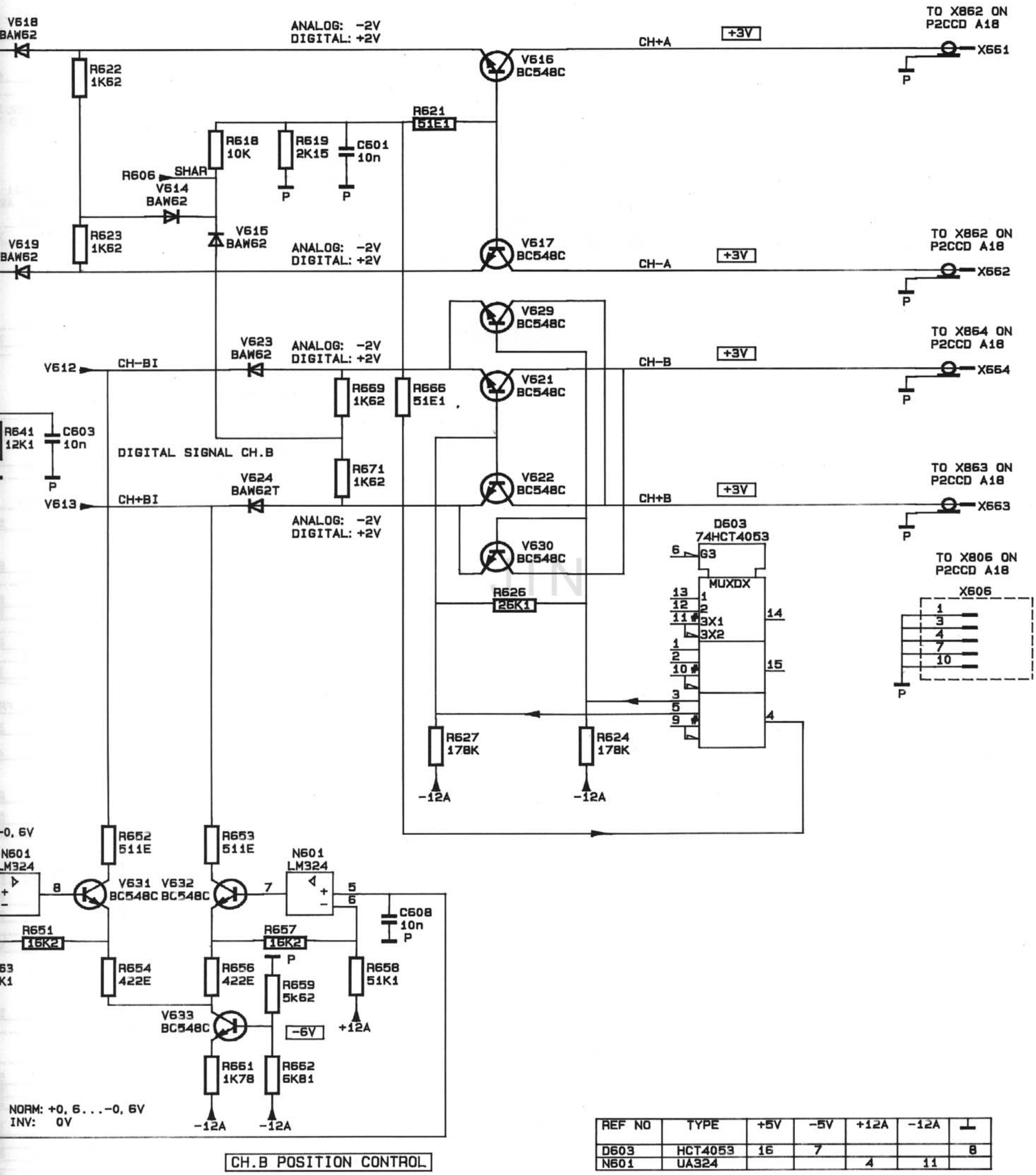


REF NO	TYPE	+5V	-5V	+12A	-12A	⊥
D603	HCT4053	16	7			8
N601	UA324			4	11	

MAT 3692B

Figure 17.4 Circuit diagram of adaptation unit: part 2


V618
BAW62
V611 CH+AI
R622
1K62
DIGITAL SIGNAL CH.A
R606 SHAR
V614
BAW62
R623
1K62
V619
BAW62
V609 CH-AI
FROM X2022 ON
PRE.AMPL.A2
X622
RANGE:
+0,6...-0,6V
POSA
R634
2K15
R633
1M
-12A
C602
10n
P
N601
LM324
R637
16K2
R636
51K1
+12A
R638
511E
V626 BC548C
V627 BC548C
R639
511E
R642
422E
R643
422E
V628
BC548C
R647
1K78
-12A
R644
16K2
R646
5K62
R648
6K81
-12A
N601
LM324
R641
12K1
C603
10n
R649
51K1
+12A
V612 CH-BI
V613 CH+BI
DIGITAL SIGNAL
CH.A POSITION CONTROL
RANGE:
+0,6...-0,6V
POSB
R629
2K15
R628
1M
-12A
D603
74HCT4053
G3
MUXDX
3X1
3X2
D601/7 INVB
R631
12K1
P
C607
10n
NORM: 0V
INV: +0,6...-0,6V
N601
LM324
R663
51K1
+12A
R651
16K2
R652
511E
V631 BC548C
V632 BC548C
R654
422E
V633
BC548C
NORM/INVERT SWITCH
NORM: +0,6...-0,6V
INV: 0V
JTN



REF NO	TYPE	+5V	-5V	+12A	-12A	⊥
D603	HCT4053	16	7			8
N601	UA324			4	11	

MAT 3692B

Figure 17.4 Circuit diagram of adaptation unit: part 2

18 P²CCD UNIT (A18) - PM3350A/52A ONLY!

The P²CCD unit consists of:

- Two separate mini CCD units which are mounted on this unit
- The ACE (Advanced Customised ECL) device with associated circuit
- The clock drivers circuits
- The Mini CCD default circuits
- The P²CCD output circuit

18.1 MINI CCD UNIT (A17)

18.1.1 INTRODUCTION

The P²CCDs for channels A and B are situated on the mini CCD units A17 which are mounted on this unit A18. The two units for ch. A and ch. B are identical.

WARNING: The P²CCD is a MOS device, which is highly sensitive to electrostatic discharges. It is not possible to replace it without causing damage, due to electrostatic discharges.

The P²CCD (Profiled Peristaltic Charge Coupled Device) - OQ0204 - which is basically an analog shift register, consists of an ODD-side and an EVEN-side. Each side consists of a sample gate of 256 stages, through which the samples can be shifted, and an output gate (see figure 18.1).

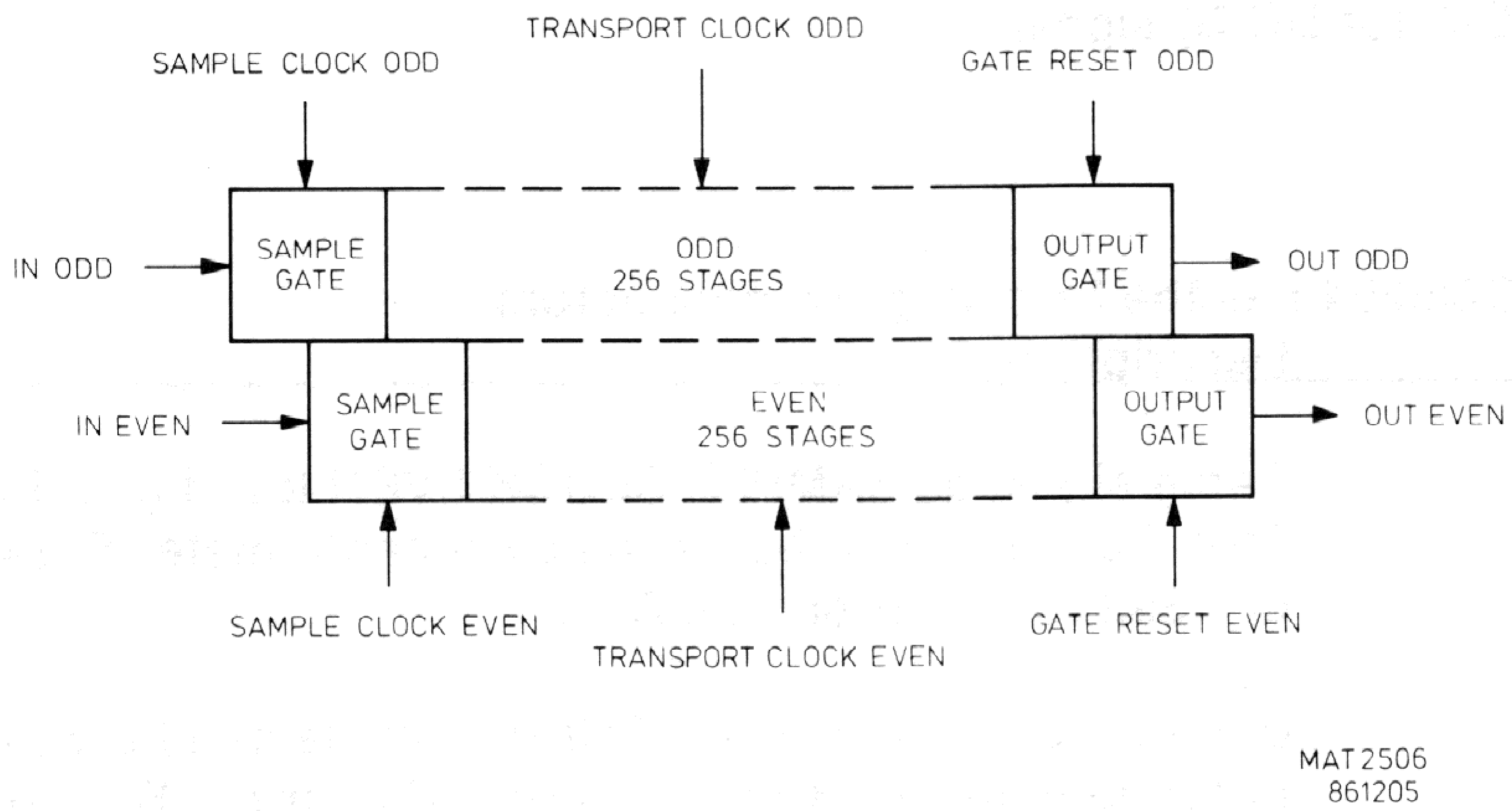


Figure 18.1 Schematic diagram of a P²CCD circuit

The clock signals of the ODD and the EVEN side are always in anti-phase (see figure 18.2).

- On the rising edge of the sample clock, a sample of the input signal is taken.
- On the falling edge of the sample clock, this sample is shifted to the first stage
- On the falling edge of the transport clock, all samples in all stages are shifted (transferred) one stage. The last sample is transferred to the output stage. The output stage is enabled when the gate reset signal is 0 V.

The P²CCD circuit applies the samples to the Clamp, Integrate and Hold circuit (CIH circuit), which takes over the samples. Then the gate reset signal is +12 V again, which resets the output capacitor.

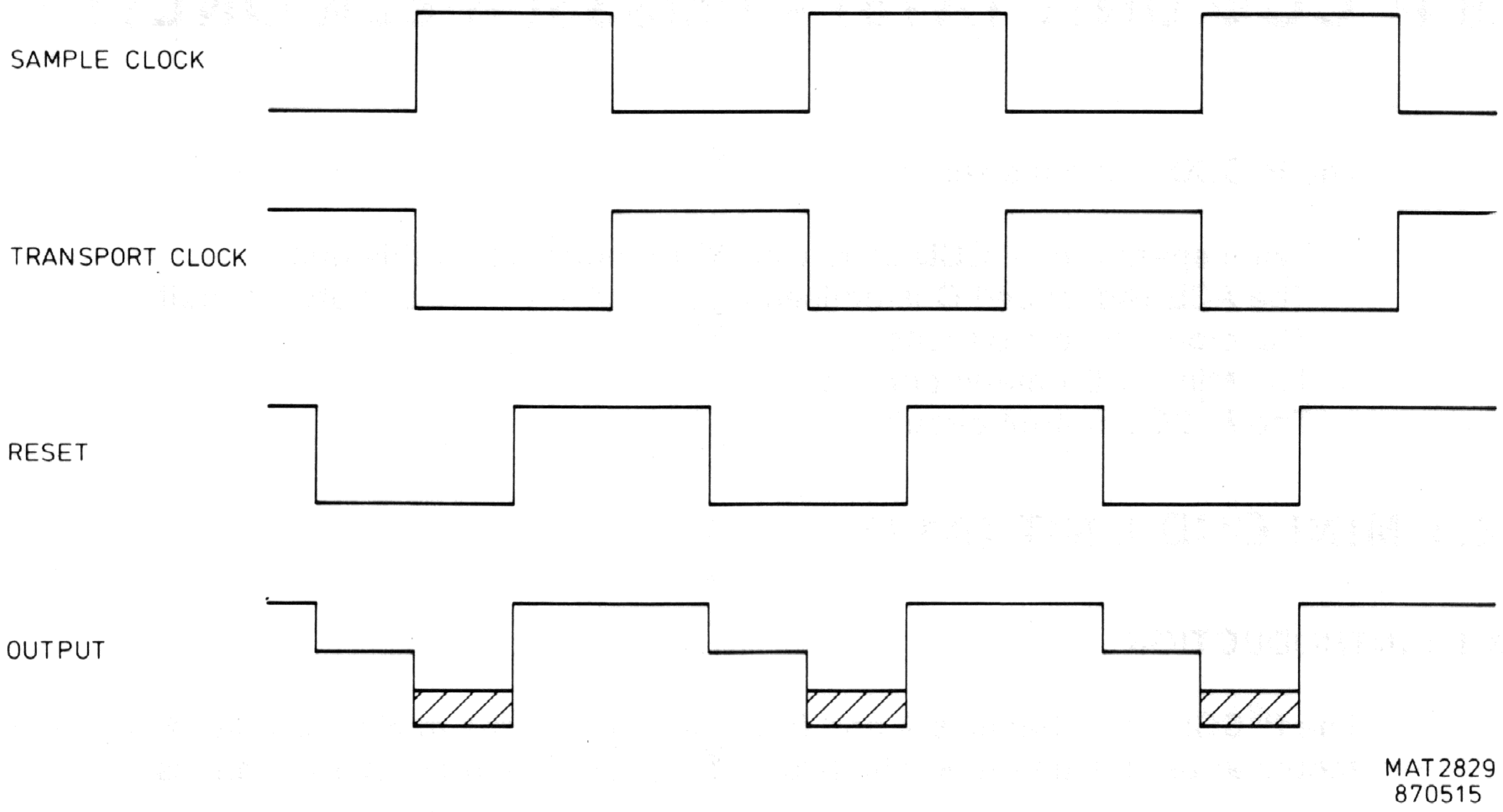


Figure 18.2 Sample and transport sequence

18.1.2 INPUT BUFFER

The differential input current with a sensitivity of 100 μA/DIV is received via 50 Ω cables from adaptation unit A16. This current is buffered by common-base amplifiers V701 and V702 and then applied to the shunt feedback amplifiers V703 and V704. This stage converts the input current into the voltage for the P^2CCD. The d.c level of this signal is controlled by the DCIA (or DCIB) signal.

18.1.3 P^2CCD - OQ0204

The P^2CCD circuit OQ0204 has the following pin connectors.

Pin	Name	Description
1	INE	Same signal as SAMPLE CLOCK EVEN but d.c. shifted. This d.c. value can be varied by potentiometer R894 for ch. A or R892 for ch. B on unit A18.
2	G1E	d.c. barrier voltage level. This d.c. value can be varied by potentiometer R974 for ch. A or R977 for ch. B on unit A18.
3	G2E	Input signal, even. The input signal can be varied by potentiometer R966 for ch. A or R970 for ch. B on unit A18.
4	G3E	SAMPLE CLOCK EVEN, takes samples of the input signal.
5	G4E	Same signal as SAMPLE CLOCK EVEN but d.c. shifted.
6	CL1IN	TRANSPORT CLOCK EVEN, transfers the samples in all 256 even stages one stage further.
7	CL2IN	Same signal as TRANSPORT CLOCK EVEN but d.c. shifted
8	SUB	Default value of -2 V approx.
9	CL20	n.c.

Pin	Name	Description
10	CL10	n.c.
11	GSP	GATE SEPARATION. Default value of +4,8 V approx.
12	OUT EVEN	Output signal even.
13	DRSE	DRAIN RESET EVEN. Default value of +19,2 V approx.
14	GRE	GATE RESET EVEN signal. When 0 V, the even output is enabled, when +12 V, the even output is disabled.
15	GRO	GATE RESET ODD signal. When 0 V, the odd output is enabled, when +12 V, the odd output is disabled.
16	DRSO	DRAIN RESET ODD. Default value of +19,2 approx.
17	OUT ODD	Output signal odd.
18	DSFS	Supply voltage of +25 V.
19	CL30	n.c.
20	CL40	n.c.
21	SUB	Default value of -2 V approx.
22	CL40	Same signal as TRANSPORT CLOCK ODD but d.c. shifted.
23	CL30	TRANSPORT CLOCK ODD, transfers the samples in all 256 odd stages one stage further.
24	G40	Same signal as SAMPLE CLOCK ODD but d.c. shifted.
25	G30	SAMPLE CLOCK ODD, takes samples of the input signal.
26	G20	Input voltage, odd. The input signal can be varied by potentiometer R966 for ch. A or R970 for ch. B on unit A18.
27	G10	d.c. barrier voltage level. This d.c. value can be varied by potentiometer R974 for ch. A or R977 for ch. B on unit A18.
28	INO	Same signal as SAMPLE CLOCK ODD but d.c. shifted. This d.c. value can be varied by potentiometer R894 for ch. A or R892 for ch. B on unit A18.

The output signals are buffered by emitter-followers V736 for EVEN and V766 for ODD and then applied to multiplexers D901 and D911 on A18.

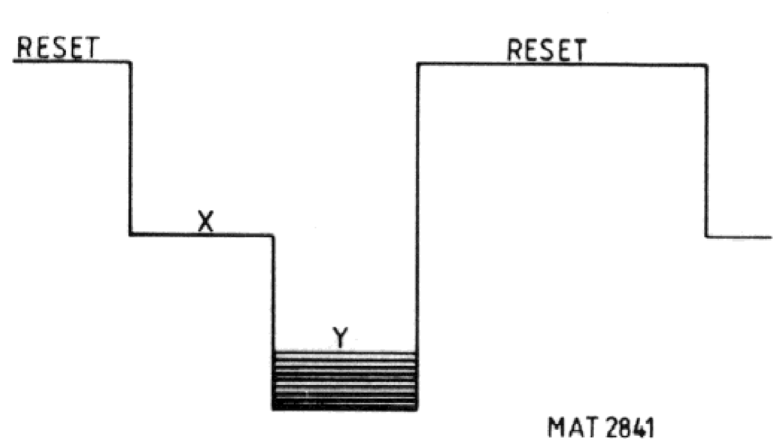


Figure 18.3 Output signal

While the output stage of the P^2CCD is reset by the GRE signal (for even samples, or GRO for odd samples) its output voltage is about 19,2 V. This voltage is determined by a resistor divider network at the DRSE input (pin 13 of the P^2CCD).
When the RESET is removed, the output drops to an undefined level X. On the falling edge of the transport clock, the sample leaves the output stage of the P^2CCD. Now the output voltage drops to level Y. The voltage difference between level X and level Y represents the value of the sample.
This voltage difference is detected by the input of the CIH circuit (see section 18.5).

The following table gives a list of sample clock frequencies and the slower read-out frequencies for all time-base position (P = P^2CCD-mode, D = Direct mode, R = Roll mode).

TIME/DIV	mode	sample clock freq.	read-out freq.
0,5 µs	P	50 MHz	50 kHz
1 µs	P	25 MHz	50 kHz
2 µs	P	12,5 MHz	50 kHz
5 µs	P	5 MHz	50 kHz
10 µs	P	2,5 MHz	50 kHz
20 µs	P	1,25 MHz	50 kHz
50 µs	P	500 kHz	50 kHz
0,1 ms	P	250 kHz	50 kHz
0,2 ms	P	125 kHz	50 kHz
0,5 ms	D1	50 kHz	50 kHz
1 ms	D1	50 kHz	50 kHz
2 ms	D1	50 kHz	50 kHz
5 ms	D2	40 kHz	40 kHz
10 ms	D2	40 kHz	40 kHz
20 ms	D2	40 kHz	40 kHz
50 ms	D2	40 kHz	40 kHz
0,1 s	D2	40 kHz	40 kHz
0,2 s	D2	40 kHz	40 kHz
0,5 s	D2	40 kHz	40 kHz
1 s	R	40 kHz	40 kHz
2 s	R	40 kHz	40 kHz
5 s	R	40 kHz	40 kHz
10 s	R	40 kHz	40 kHz
20 s	R	40 kHz	40 kHz
50 s	R	40 kHz	40 kHz

Note: *In P and D1 mode (time-base settings: 0,5 µs/div...2 ms/div), the P^2CCDs act as time converters: the read-in frequency is higher then the read-out frequency.*
In D2 and R mode (time-base settings: 5 ms/div...0,5s/div), the P^2CCDs act as analog shift registers: the read-in frequency is the same as the read-out frequency.

18.1.4 SIGNAL NAME LIST OF THE MINI CCD UNIT

Signal name	Description	Signal source	Signal destination(s)
BARA	Barriër ch. A	R974	R770
BARB	Barriër ch. B	R977	R770
BIASA	Bias voltage ch. A	R894	N701
BIASB	Bias voltage ch. B	R892	N701
CH+A	Channel +A input	V616	R702
CH-A	Channel -A input	V617	R707
CH+B	Channel +B input	V622	R702
CH-B	Channel -B input	V621	R701
DCIA	DC level in ch. A	N921	R715
DCIB	DC level in ch. B	N922	R715
DCOA	DC level out ch. A	R717/R718	N921
DCOB	DC level out ch. B	R717/R718	N922
OUTAEV	Output ch. A even	V736	D911
OUTAOD	Output ch. A odd	V766	D901
OUTBEV	Output ch. B even	V736	D911
OUTBOD	Output ch. B odd	V766	D901
RSTEV-LT	Reset even	R407	R751
RSTOD-LT	Reset odd	R406	R781
SCEAM	Sample clock even ch. A	L806	D731
SCEBM	Sample clock even ch. B	L836	D731
SCOAM	Sample clock odd ch. A	L801	D731
SCOBM	Sample clock add ch. B	L831	D731
TCEAM	Transport clock even ch. A	L822	D731
TCEBM	Transport clock even ch. B	L852	D731
TCOAM	Transport clock odd ch. A	L816	D731
TCOBM	Transport clock odd ch. B	L846	D731

18.2 ACE (ADVANCED CUSTOMISED ECL)

The CCD logic and fast time-base divider are integrated in an ECL-GATE-ARRAY D801. It contains various fast dividers to generate the sample and transport clock from the FCH and FCL signals in P-mode. It also contains the logic for the change over to the slow clock (SWCK) for the read out stroke in P-mode. In the Direct mode the sample and transport clocks are derived from SWTB.

In D-mode, the sample and transport clock has a clock-frequency of 50 kHz (D1 mode) or 40 kHz (D2 mode). These frequencies are derived from signal SWCK (100 kHz in D1 mode and 80 kHz in D2 mode).

In P-mode the delay counter indicates the moment when the P^2CCD is read. The delay counter consists of a 4-bit presettable counter, internal in the ECL-GATE-ARRAY, and a 16-bit external counter D887.

The output lines are at ECL level (-0,9 V...-1,7 V).
The output signals TCEV, CDRD, DTUF and DCC are buffered and converted into a TTL level.

The digital time-base generator in P-mode is driven by a 100 MHz crystal oscillator. The oscillator can be switched-on and -off by the signal OSCON-LT.

18.3 CLOCK DRIVERS

Each SAMPLE AND TRANSPORT clock driver consists of two transistors with a current source. To increase the bandwidth of the signal, a coil is added between the collector and the gate capacitance of the P^2CCD; the sample clock drivers are buffered by a bridged T-network.

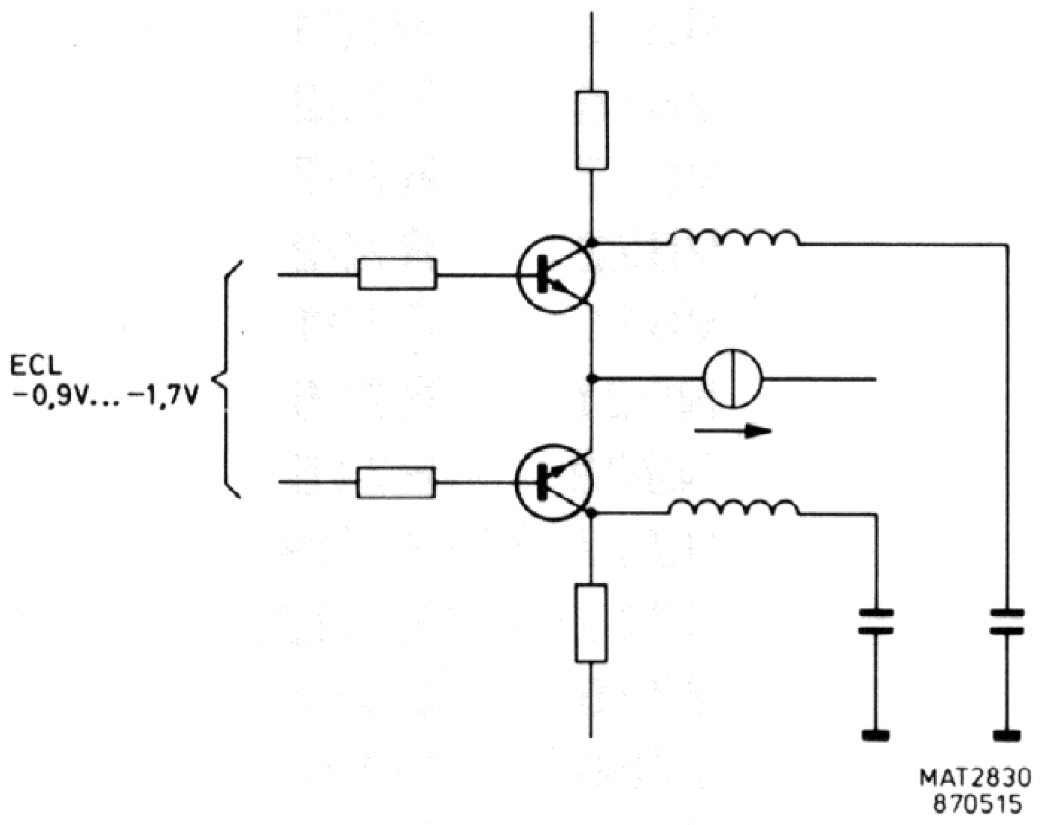


Figure 18.4 Principle of the sample clock drivers

The inputs are at ECL level (-0,9 V...-1,7 V) and are derived from the ACE. These are converted into a 0 ... 9 V signal for the sample clock drivers or 0...6 V signal for the transport clock drivers.

18.4 MINI CCD DEFAULT CIRCUITS

The default settings BIAS A (BIAS B) and +27 V for the P^2CCD are obtained by resistor dividers or by a zener diode. The d.c. value of BIAS A (BIAS B) can be varied by potentiometer R894 (R892).

The level shifter D921 converts the TTL signals DISOD-HT, DISEV-HT, SPOD and SPEV into the same signals but at CMOS level (signal between 0... +12 V). The sample signal SAMPLEHT is split up into a sample Odd or sample Even signal by D922.

18.5 P²CCD OUTPUT

The P²CCD output circuit consists of 4 CIH (Clamp Integrate Hold) circuits, followed by the analog leakage correction.

Since channel A and B are identical (and the even and odd side of each channel are identical) only channel A odd side of the CIH is described.

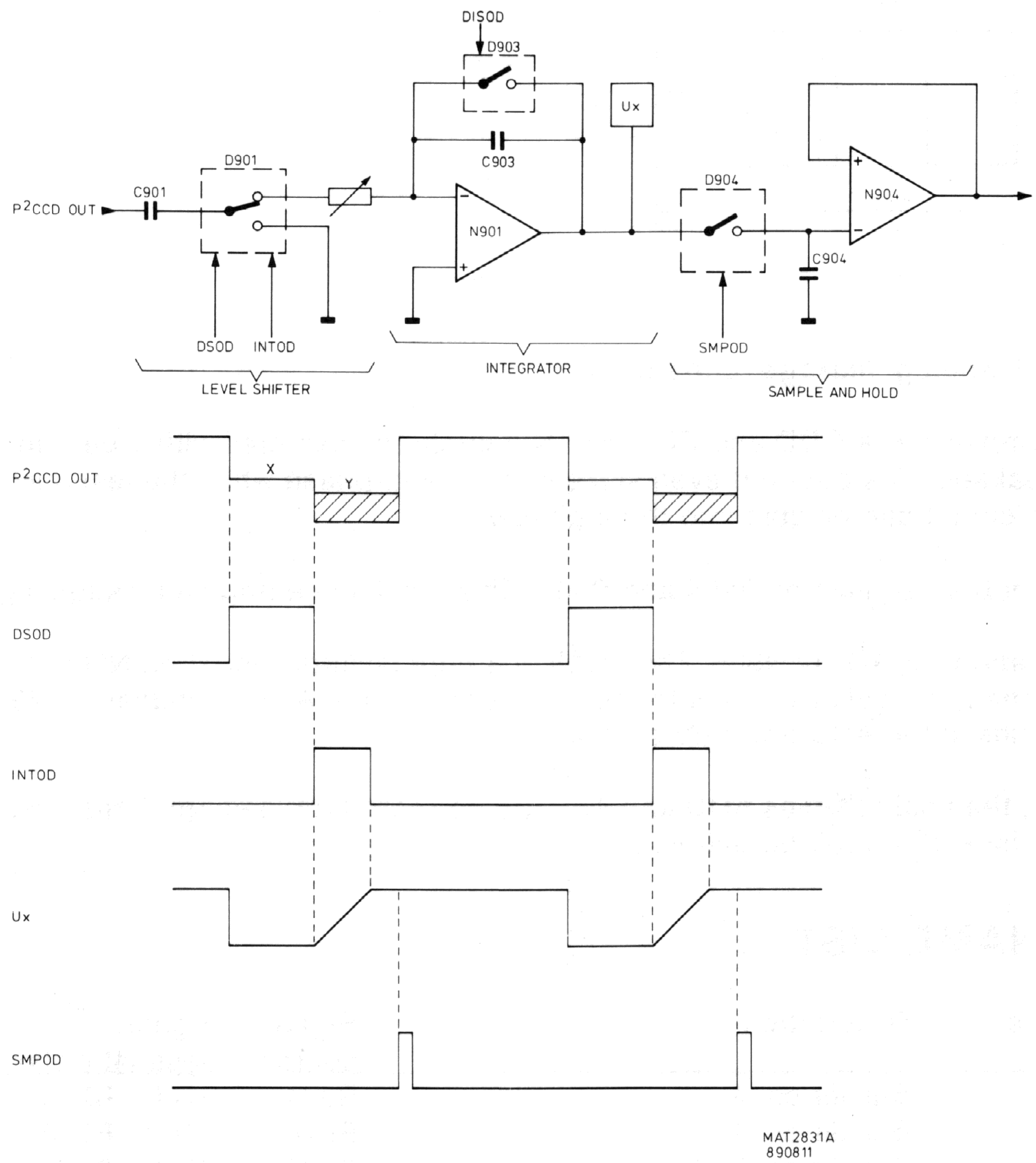


Figure 18.5 CIH circuit

The CIH receives its signal from the P²CCD.
The first stage is multiplexer D901, which serves as a level shifter. D901 detects the voltage difference between level X and Y which represents the value of the sample and sets the voltage reference level X to 0 V. When DSOD is high, capacitor C901 is clamped to ground and charged to the voltage X. Then, when INTOD is high, capacitor C901 passes this d.c. sample voltage Y-X to the next stage.

The second stage, integrator N901 has two functions: it filters and amplifies the sample voltage. During the time that INTOD is high the sample voltage is present and the output of N901 is rising linearly. Then when INTOD is low again, the output of N901 gives a constant voltage. Next, when DISOD is high capacitor C903 is short-circuited by D903 and is discharged so that it is ready for a new cycle. The output of this stage is buffered by a dual FET V903.

The third stage is the sample and hold circuit D904. The constant output voltage of the previous stage charges the hold capacitor C904 during the time that SMPOD is high. If SMPOD is low, the capacitor C904 is isolated from the second stage and holds its charge; the output voltage of N904 is now constant.

The outputs of the odd and even signals of ch. A (B) are applied to the analog leakage correction.

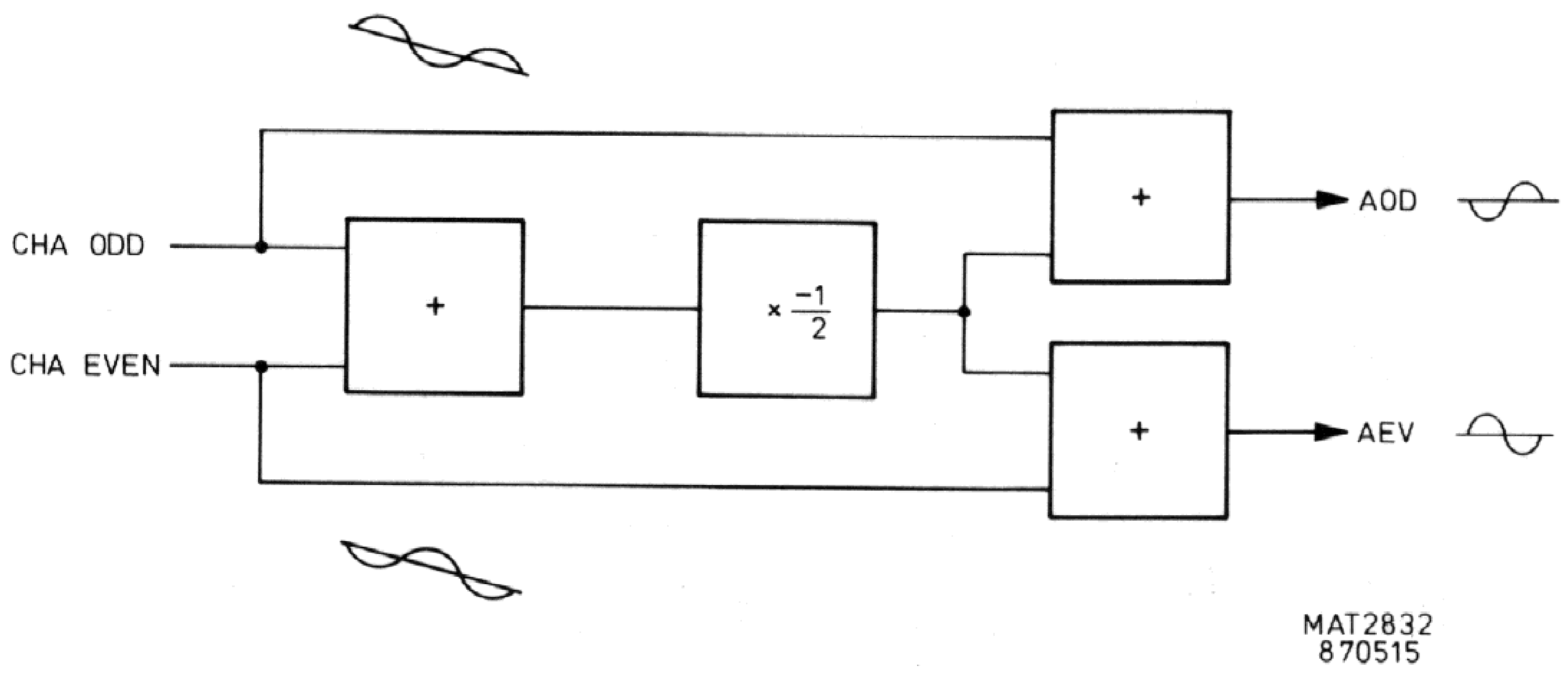


Figure 18.6 Analog leakage correction

The two samples CH.A ODD and CH.A EVEN contain the samples with a certain analog common leakage. The odd and even signals are in anti-phase while the leakage is in phase. The circuit can be split into three phases:

- Adding of both signals by R904 and R909. This results in a double leakage signal on N905-6.
- Amplification by -1/2 by N905. The result is a pure leakage signal on N905-7.
- Adding the pure leakage signal to the ch. A odd (or: ch. A even) signal by N927-2. This results in the AOD and AEV signals.

In this way, the final samples AOD and AEV are corrected for leakage. These samples are applied to the ADC circuit on unit A15.

18.6 SIGNAL NAME LIST

Signal name	Description	Signal source	Signal destination(s)
BARA	Barriër ch. A	R974	R760 - R770
BARA	Barriër ch. A	R974	R760 - R770
BARB	Barriër ch. B	R977	R760 - R770
BIASA	Bias voltage ch. A	R894	N701
BIASB	Bias voltage ch. B	R892	N701
CDRD-HT	CCD read	R883	D406 - D411
CHAOD	Channel A odd signal	R927	R501
CHAEV	Channel A even signal	R937	R502
CHBOD	Channel B odd signal	R947	R508
CHBEV	Channel B even signal	R957	R509
DCCLK	Delay counter clock	R886	D218
DCIA	DC level in ch. A	N921	R715
DCIB	DC level in ch. B	N922	R715
DCOA	DC level out ch. A	R717/718	R968
DCOB	DC level out ch. B	R717/718	R972
DCWE-HT	Delay counter write	D316	D801
DISEV-HT	Discharge even (5V)	R403	D921 - D922
DISOD-HT	Discharge odd (5V)	R404	D921 - D922

Signal name	Description	Signal source	Signal destination(s)
DSEV-HT	Discharge even (12V)	D921	D903
DSOD-HT	Discharge odd (12V)	D921	D903
DTTC-LT	Delay trigger terminal count	D218	D801
DTUF-HT	Delay trigger underflow	R884	D402
ED0...3	Buffered data bus	R413...417	D801
EDC--LT	Enable delay counter	R401	D221 - D801
FCH	Fast clock high	R874	D801
FCL	Fast clock low	R875	D801
INTEV-HT	Integrate even	R411	D911
INTOD-HT	Integrate odd	R409	D901
OUTAEV	Output ch. A even	V736	D911
OUTAOD	Output ch A odd	V766	D901
OUTBEV	Output ch. A even	V736	D911
OUTBOD	Output ch. B odd	V766	D901
OSCON-LT	Enable P-mode/100 MHz	D313	D407 - D801 - R862
RSSW	Reset slow clock	R407	D801
SAMPLEHT	Sample clock	R408	D922
SCEA	Sample clock even ch. A	D801	R806
SCEAM	Sample clock even ch. A	L806	D731
SCEB	Sample clock even ch. B	D801	R836
SCEBM	Sample clock even ch. B	L836	D731
SCOA	Sample clock odd ch. A	D801	R801
SCOAM	Sample clock odd ch. A	L801	D731
SCOB	Sample cleck odd ch. B	D801	R831
SCOBM	Sample clock odd ch. B	L831	D731
SMPEV-HT	Sample even	D921	D914
SMPOD-HT	Sample odd	D921	D904
STWE-HT	Status write	D316	D801
SWCK	Slow clock	D412	D801
SWTB	Slow time base	D218	D801 - D412
TBWE-HT	Time base write	D316	D801
TCEA	Transport clock even ch. A	D801	R822
TCEAM	Transport clock even ch. A	L822	D731 - R747
TCEB	Transport clock even ch. B	D801	R852
TCEBM	Transport clock even ch. B	L852	D731 - R747
TCEV-LT	Transport clock even	R882	D401 - D408 - D411
TCOA	Transport clock odd ch. A	D801	R816
TCOAM	Transport clock odd ch. A	L816	D731 - R777
TCOB	Transport clock odd ch. B	D801	R846
TCOBM	Transport clock odd ch. B	L846	D731 - R777

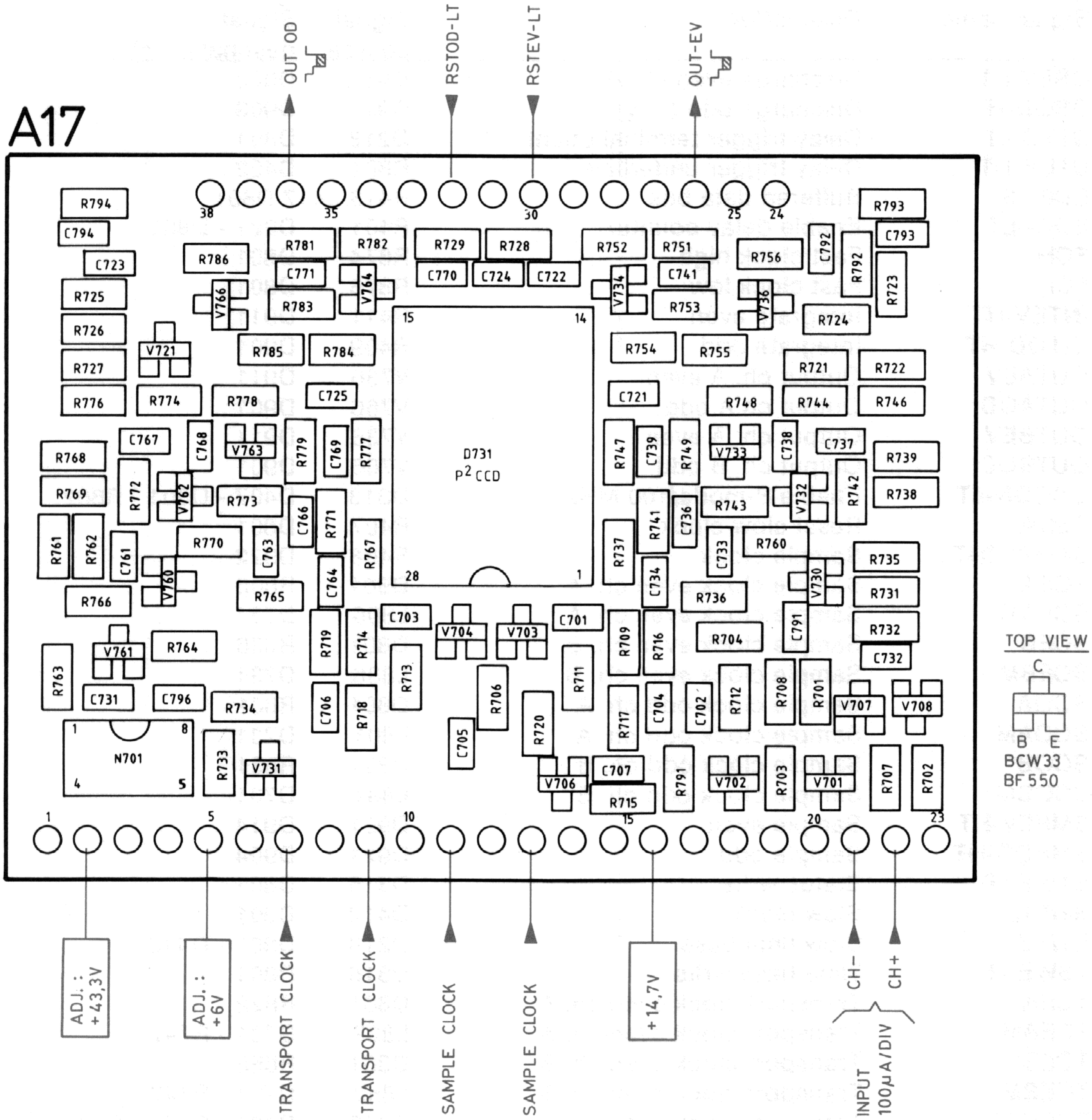


Figure 18.7 Mini CCD unit p.c.b.

MAT3583A

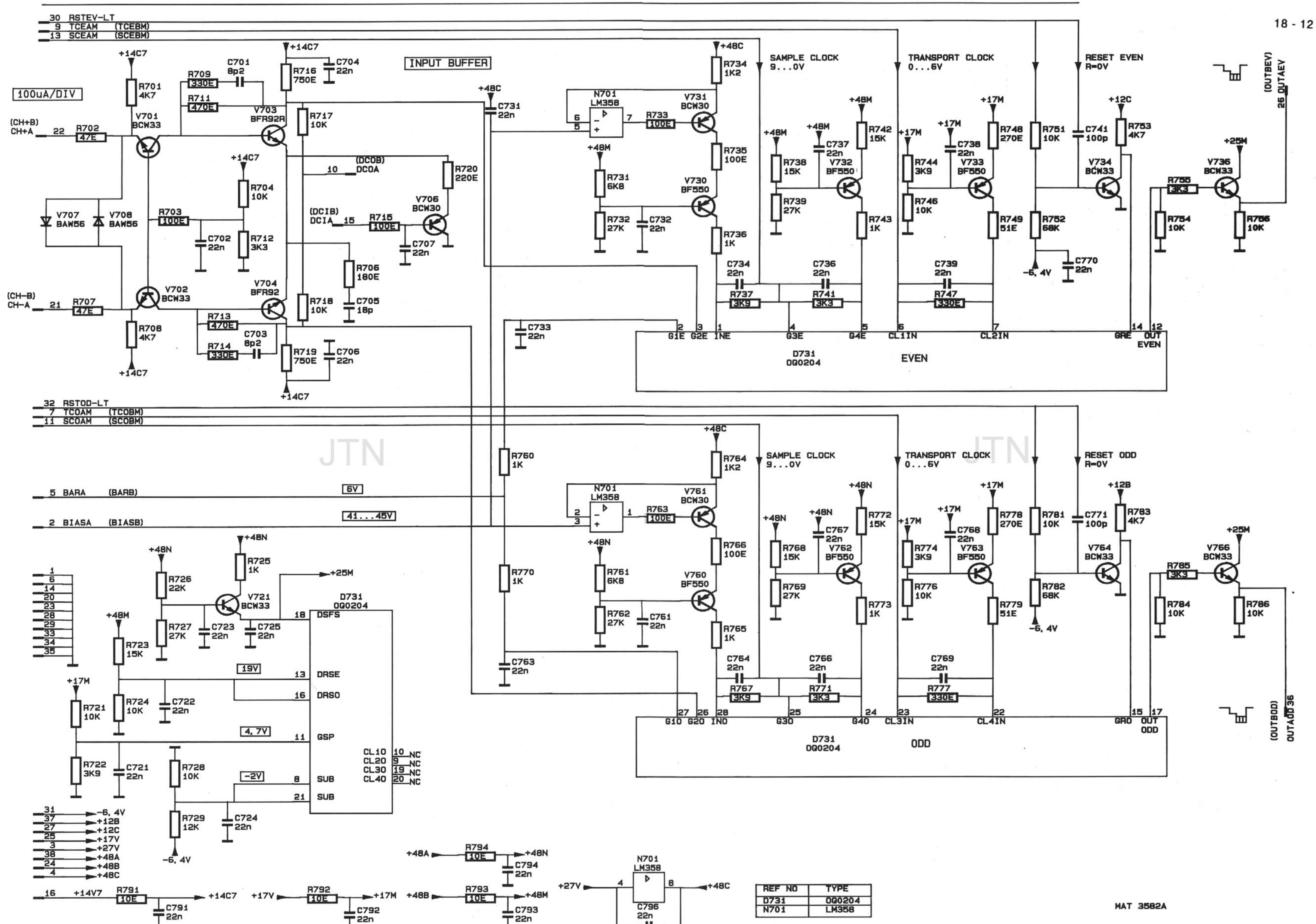


Figure 18.8 Circuit diagram of mini CCD unit

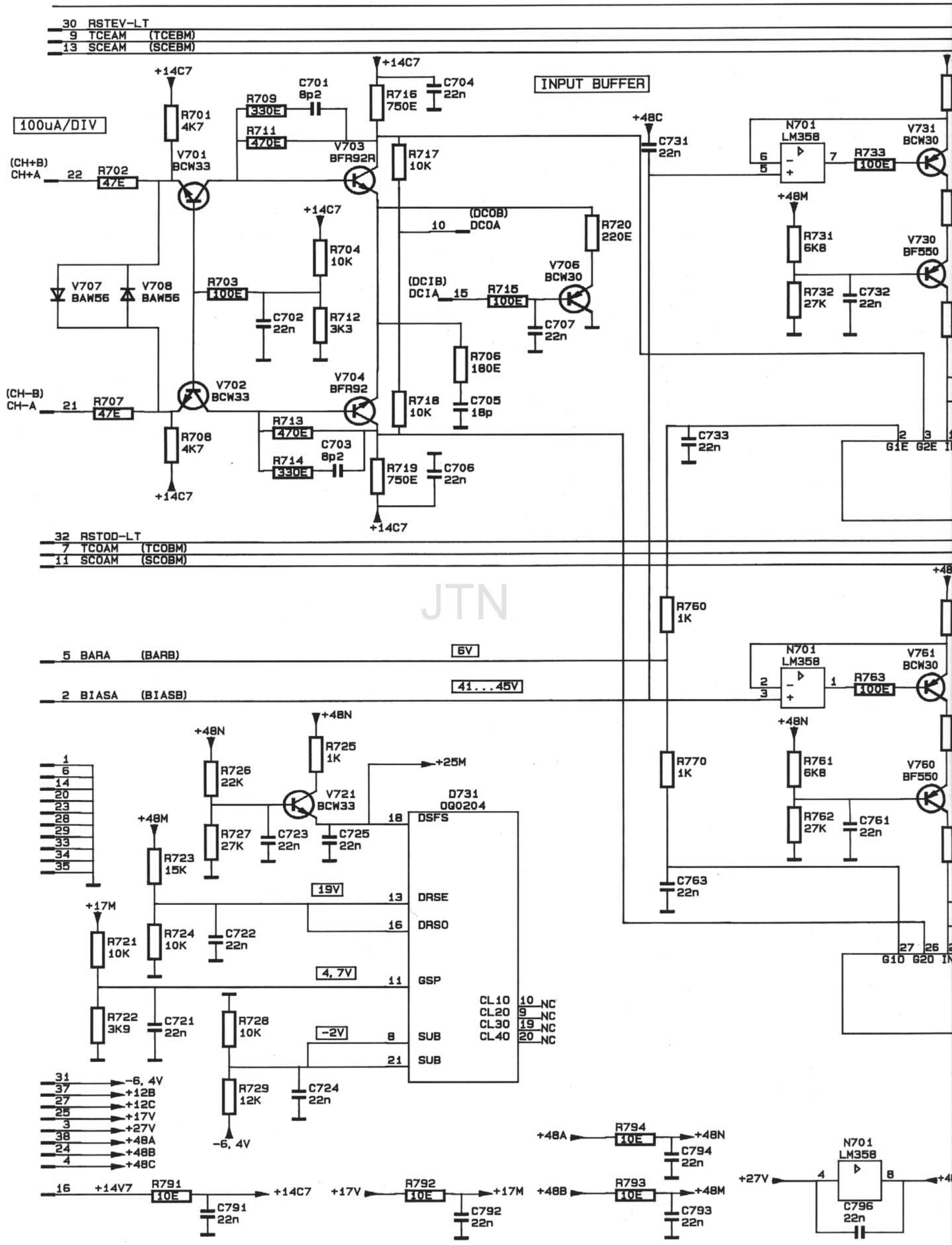
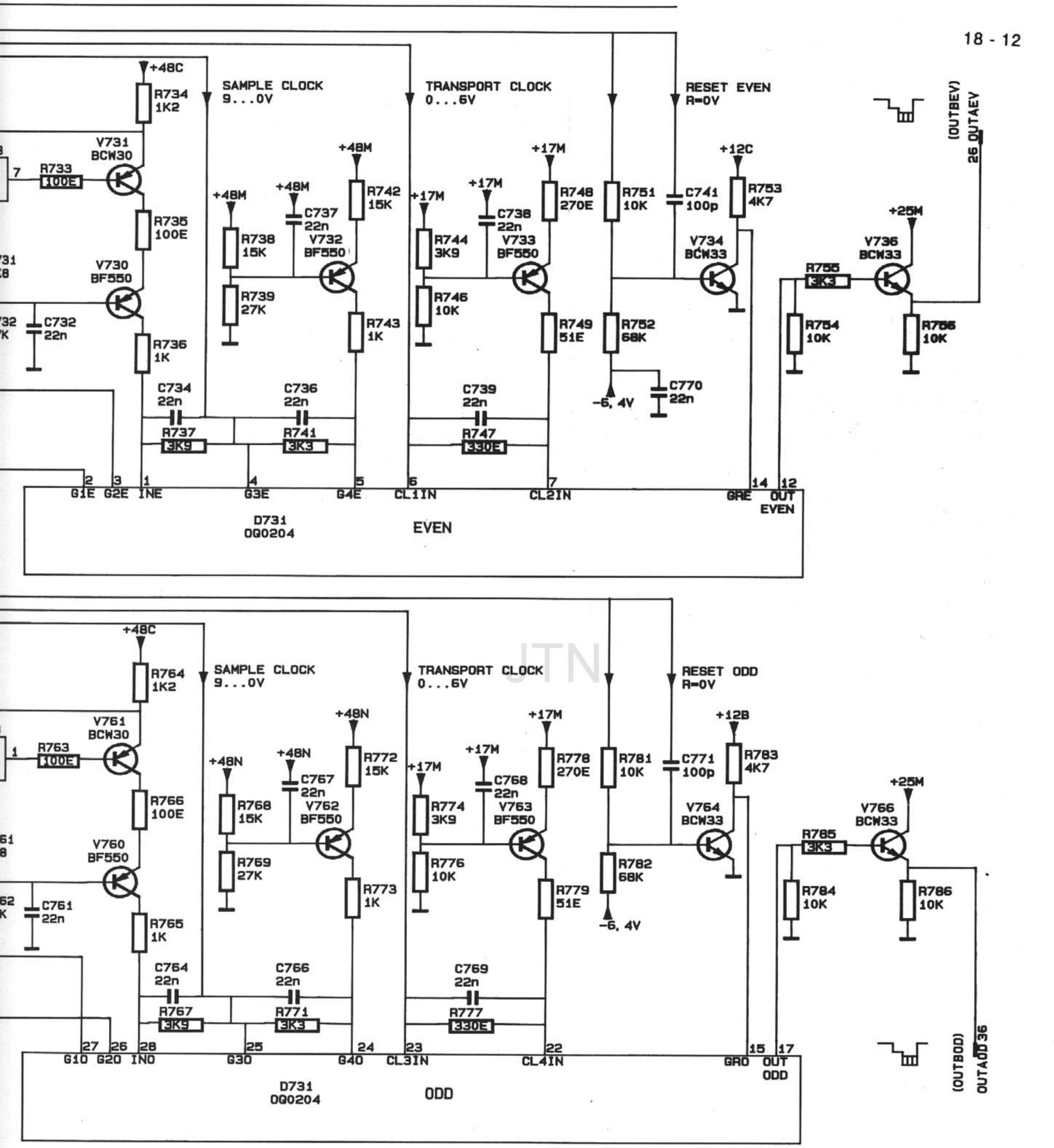
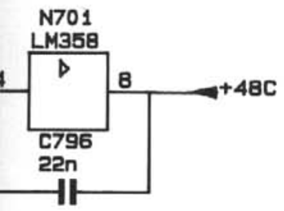


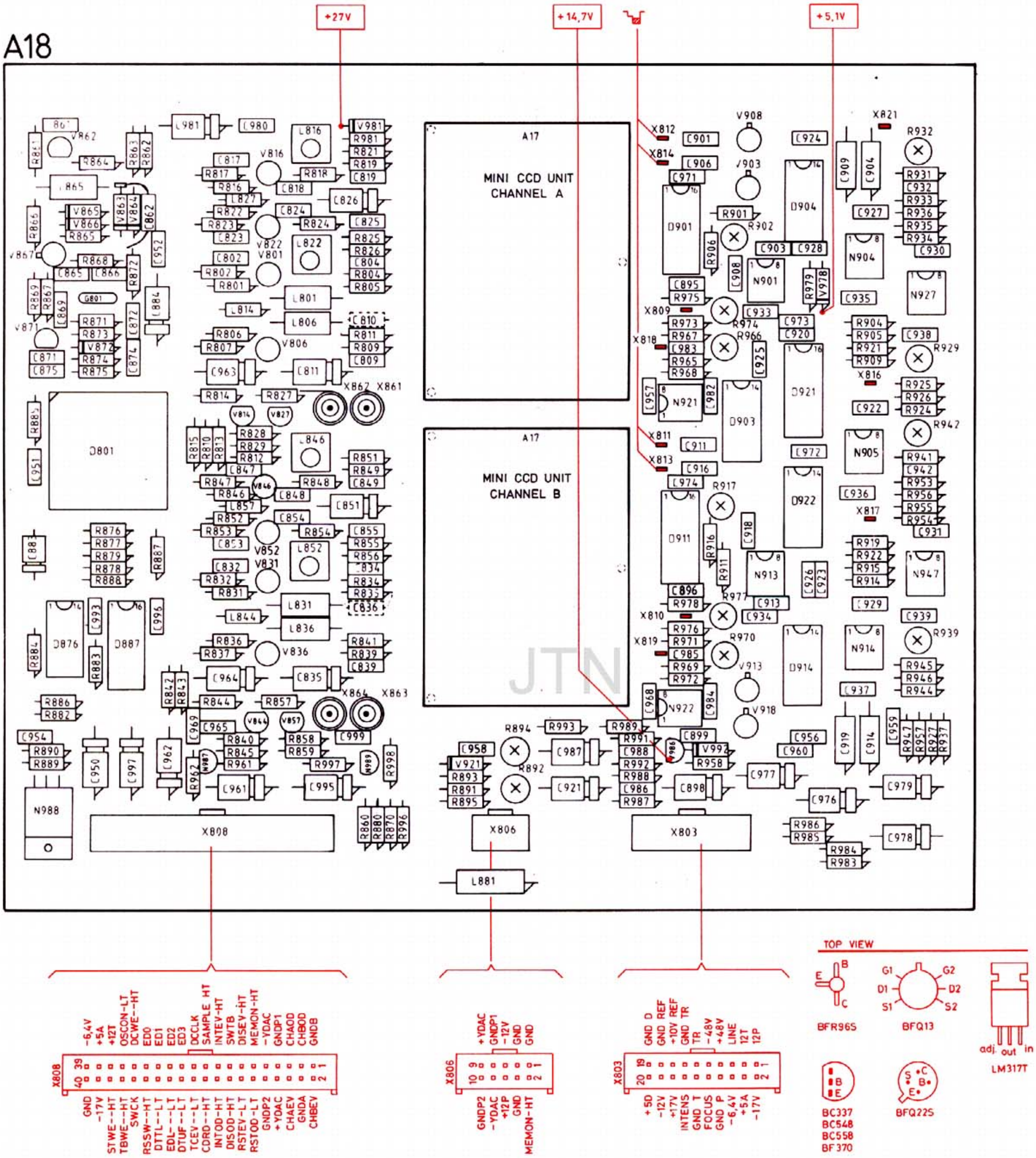
Figure 18.8 Circuit diagram of mini CCD unit





REF NO	TYPE
D731	OQ0204
N701	LM358

MAT 3582A



TEST PIN	SIGNAL	ADJUSTING ELEMENT
X809	BAR (TRESHOLD) A	R974
X810	BAR (TRESHOLD) B	R977
X811	OUTAEV	R966
X812	OUTAOD	R966
X813	OUTBEV	R970
X814	OUTBOD	R970
X816	LEAKAGE A	R902
X817	LEAKAGE B	R917
X818	DC LEVEL A	R966
X819	DC LEVEL B	R970
X821	GND	--

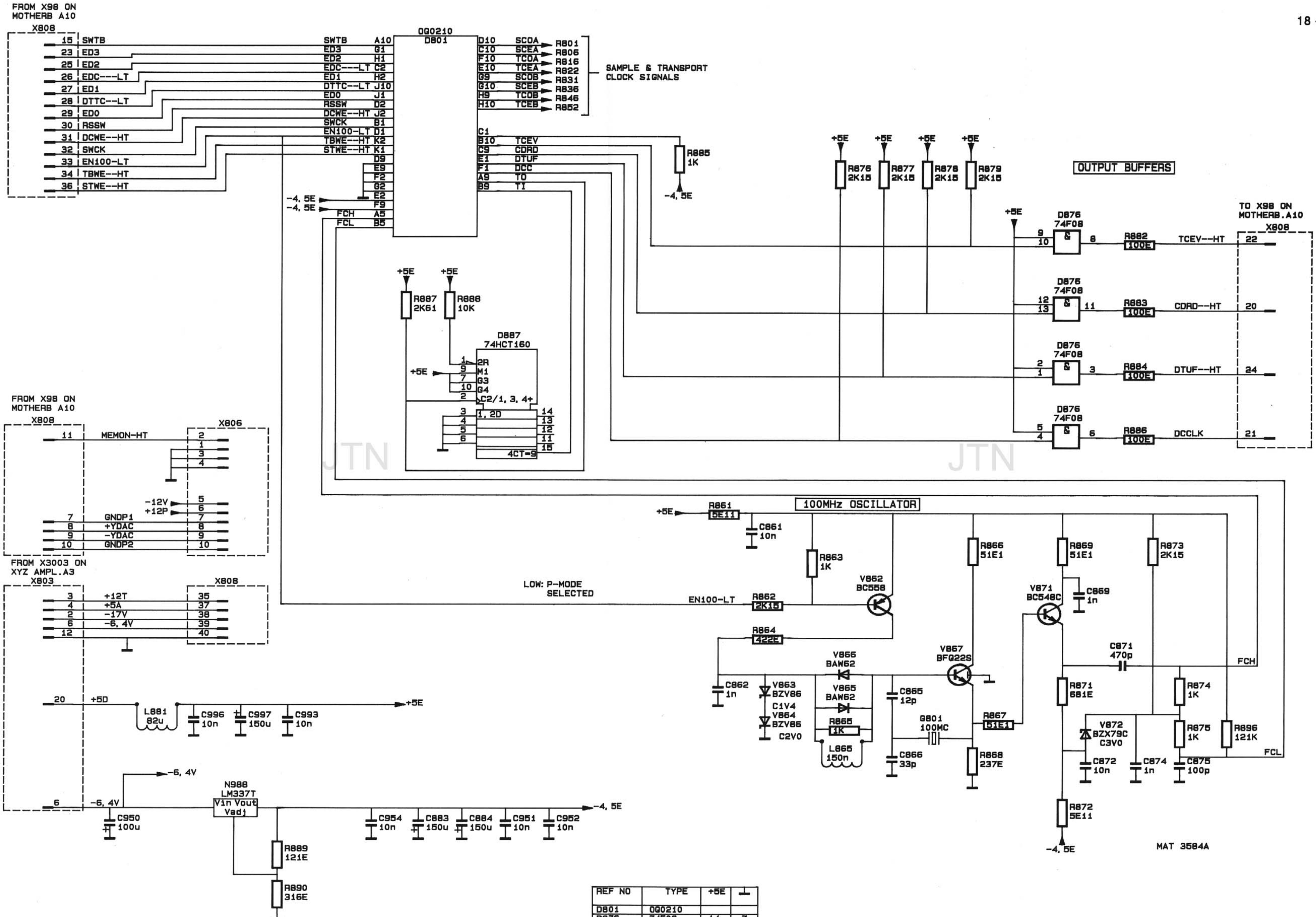
ADJUSTING ELEMENTS:	
R892	BIAS B
R894	BIAS A
R902	LEAKAGE CORRECTION
R917	LEAKAGE CORRECTION
R929	GAIN A
R932	OFFSET A
R939	GAIN B
R942	OFFSET B
R966	DC LEVEL A
R970	DC LEVEL B
R974	TRESHOLD A
R977	TRESHOLD B

50 Ω CABLE CONNECTIONS:

PIN:	SIGNAL:	DERIVED FROM:
X861	CH+A	X661 (PM3350A)
	CH+A	X1661 (PM3365A)
X862	CH−A	X662 (PM3350A)
	CH−A	X1662 (PM3365A)
X863	CH+B	X663 (PM3350A)
	CH+B	X1663 (PM3365A)
X864	CH−B	X664 (PM3350A)
	CH−B	X1664 (PM3365A)

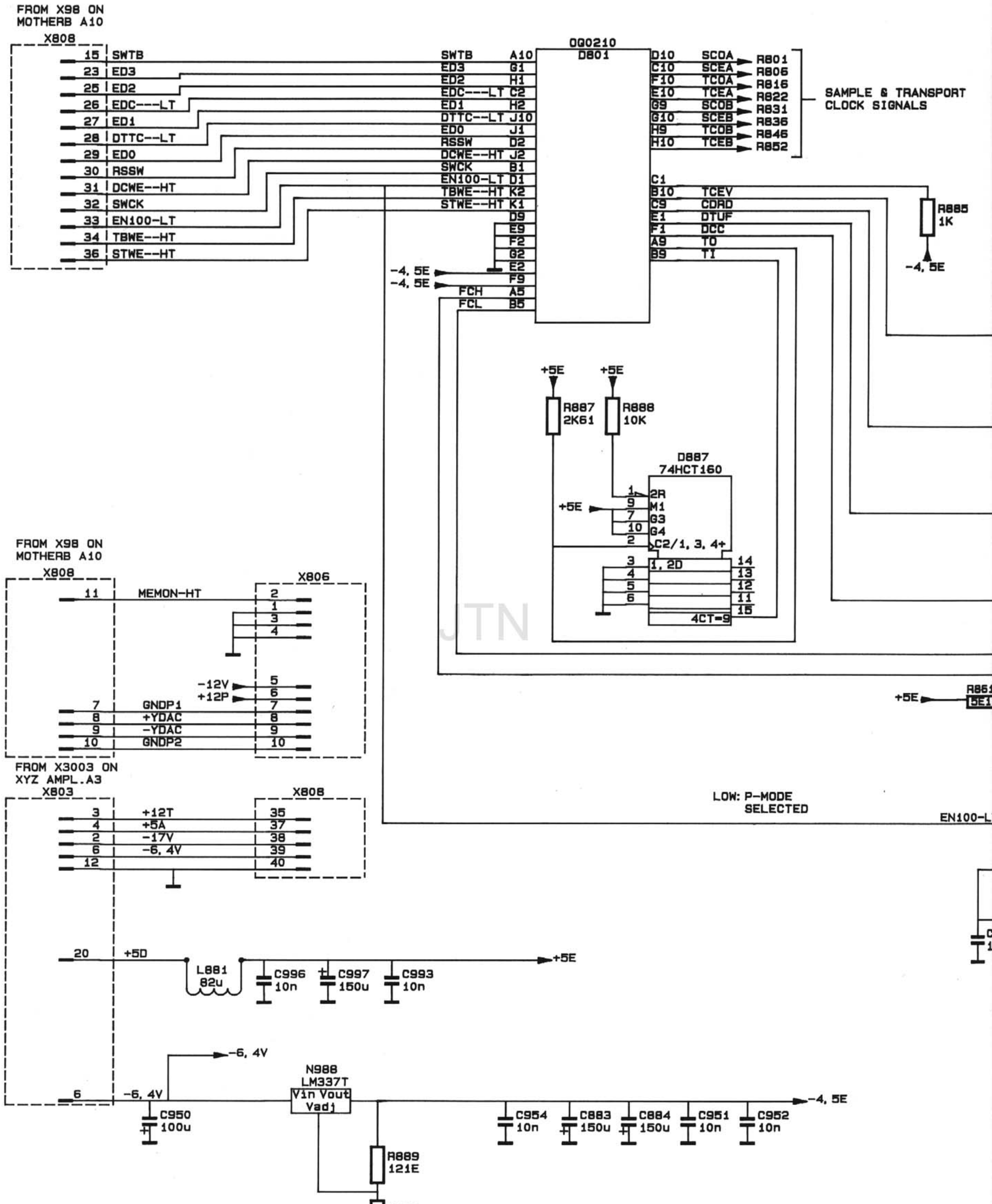
MAT3588A

Figure 18.9 P^2CCD unit p.c.b.



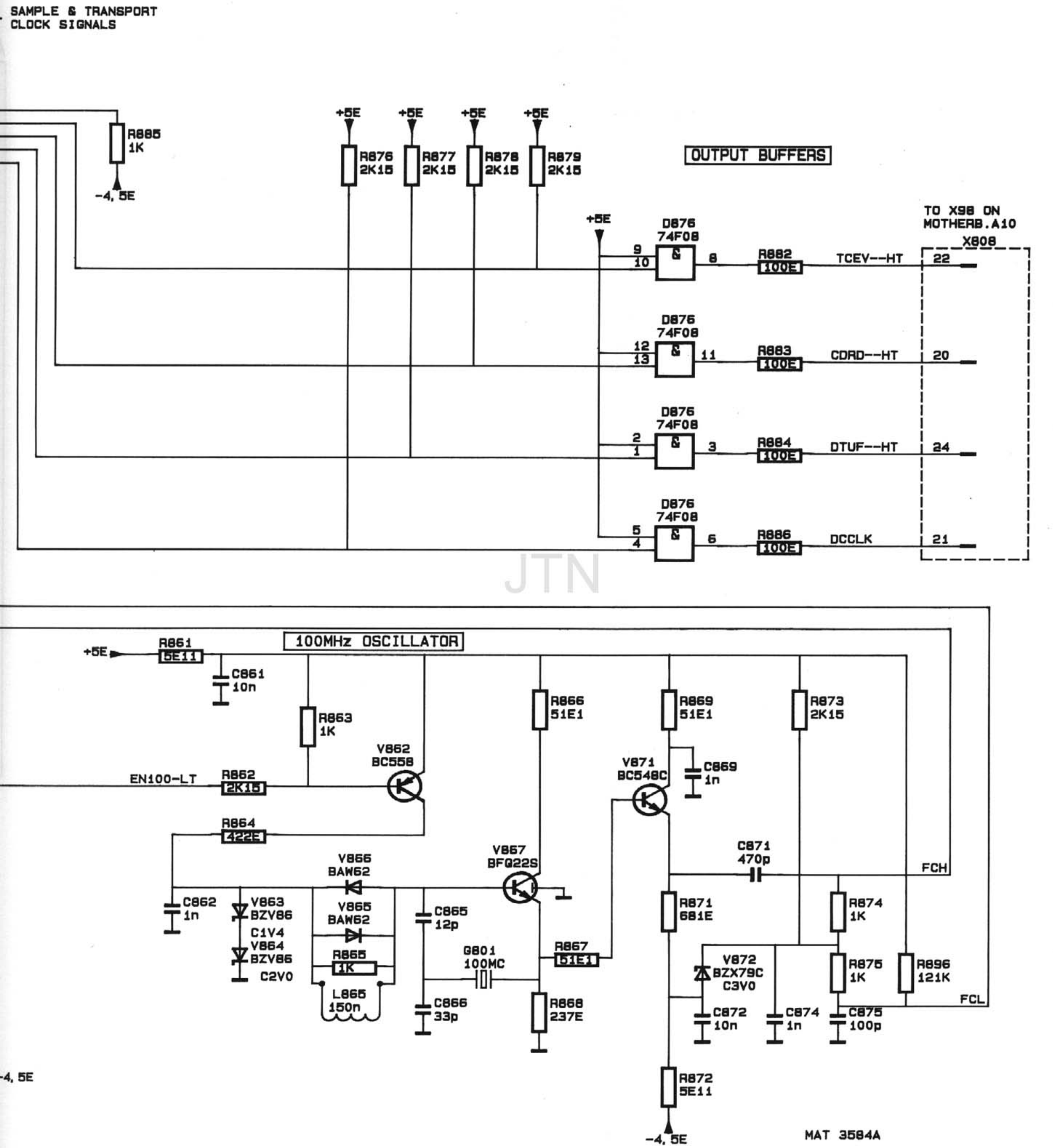
REF NO	TYPE	+5E	⊥
D801	0Q0210		
D876	74F08	14	7
D887	74HCT160	16	8

Figure 18.10 Circuit diagram of P^2CCD: ACE

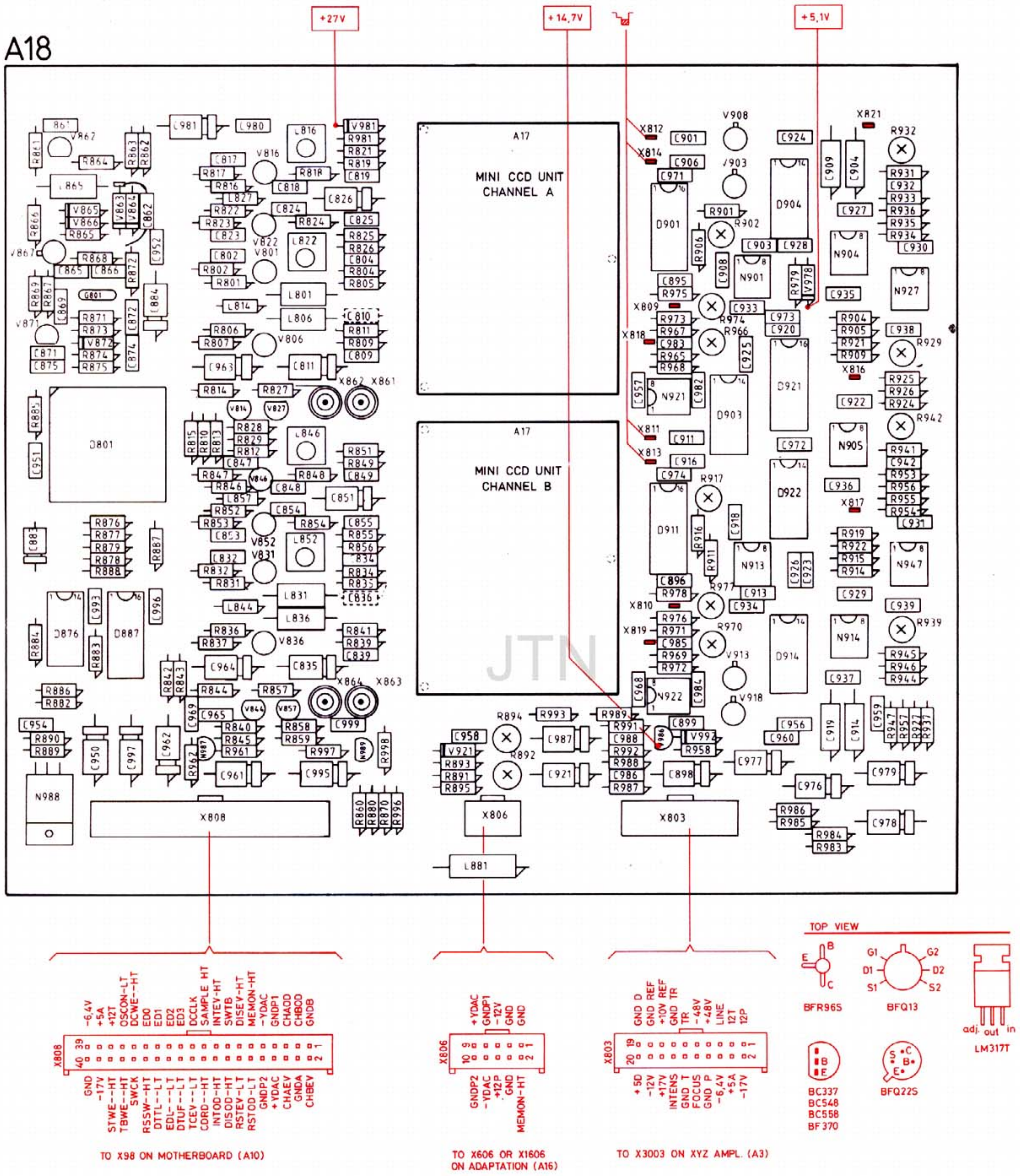


REF NO	TYPE	+5E
D801	0Q0210	
D876	74F08	14
D887	74HCT160	16

Figure 18.10 Circuit diagram of P^2CCD: ACE



REF NO	TYPE	+5E	⊥
D801	OQ0210		
D876	74F08	14	7
D887	74HCT160	16	8



TEST PIN	SIGNAL	ADJUSTING ELEMENT
X809	BAR (TRESHOLD) A	R974
X810	BAR (TRESHOLD) B	R977
X811	OUTAEV	R966
X812	OUTAOD	R966
X813	OUTBEV	R970
X814	OUTBOD	R970
X816	LEAKAGE A	R902
X817	LEAKAGE B	R917
X818	DC LEVEL A	R966
X819	DC LEVEL B	R970
X821	GND	--

ADJUSTING ELEMENTS:	
R892	BIAS B
R894	BIAS A
R902	LEAKAGE CORRECTION
R917	LEAKAGE CORRECTION
R929	GAIN A
R932	OFFSET A
R939	GAIN B
R942	OFFSET B
R966	DC LEVEL A
R970	DC LEVEL B
R974	TRESHOLD A
R977	TRESHOLD B

50 Ω CABLE CONNECTIONS:

PIN:	SIGNAL:	DERIVED FROM:
X861	CH+A	X661 (PM3350A)
	CH+A	X1661 (PM3365A)
X862	CH−A	X662 (PM3350A)
	CH−A	X1662 (PM3365A)
X863	CH+B	X663 (PM3350A)
	CH+B	X1663 (PM3365A)
X864	CH−B	X664 (PM3350A)
	CH−B	X1664 (PM3365A)

MAT3588A

Figure 18.11 P²CCD unit p.c.b.

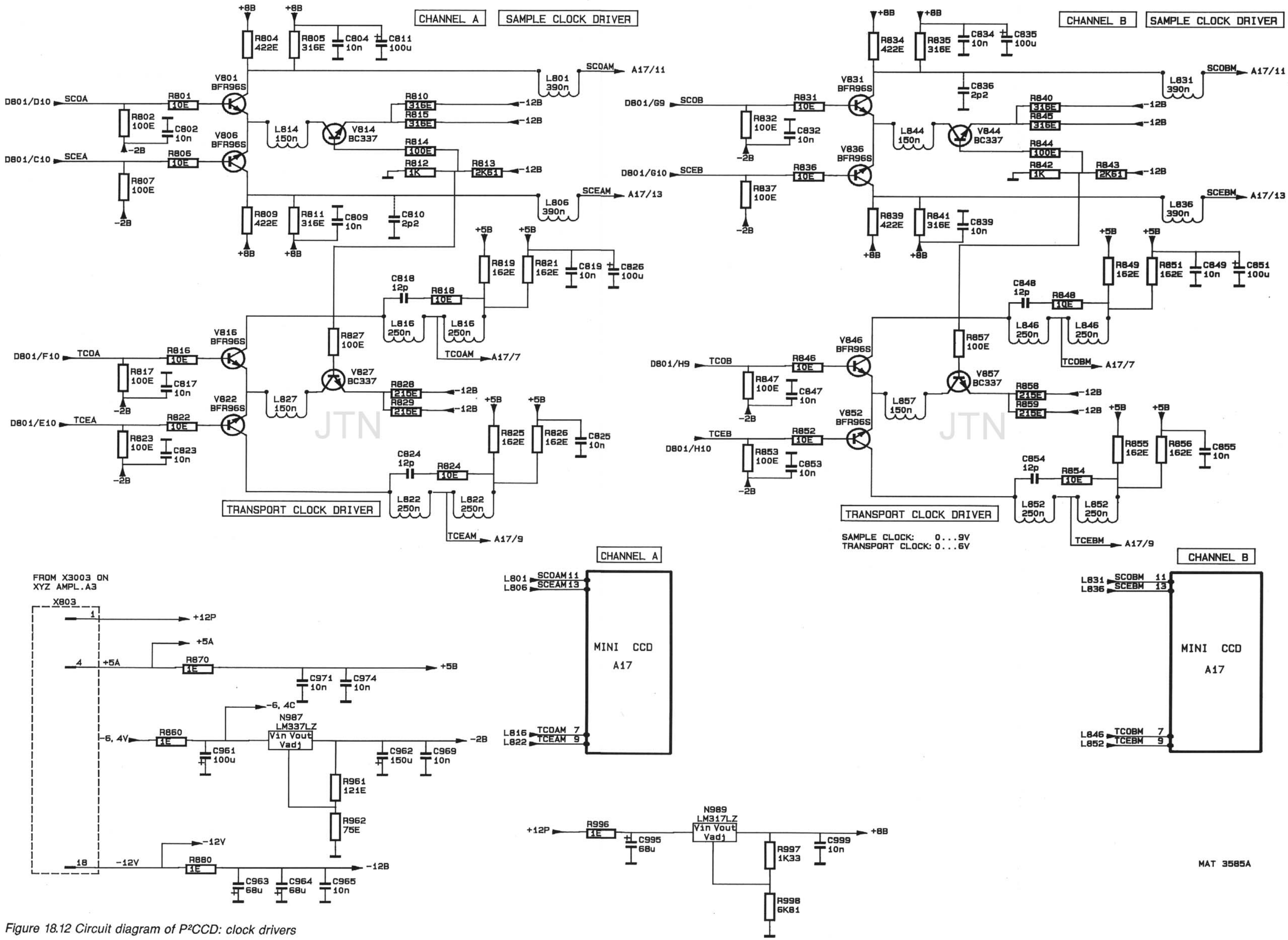


Figure 18.12 Circuit diagram of P²CCD: clock drivers

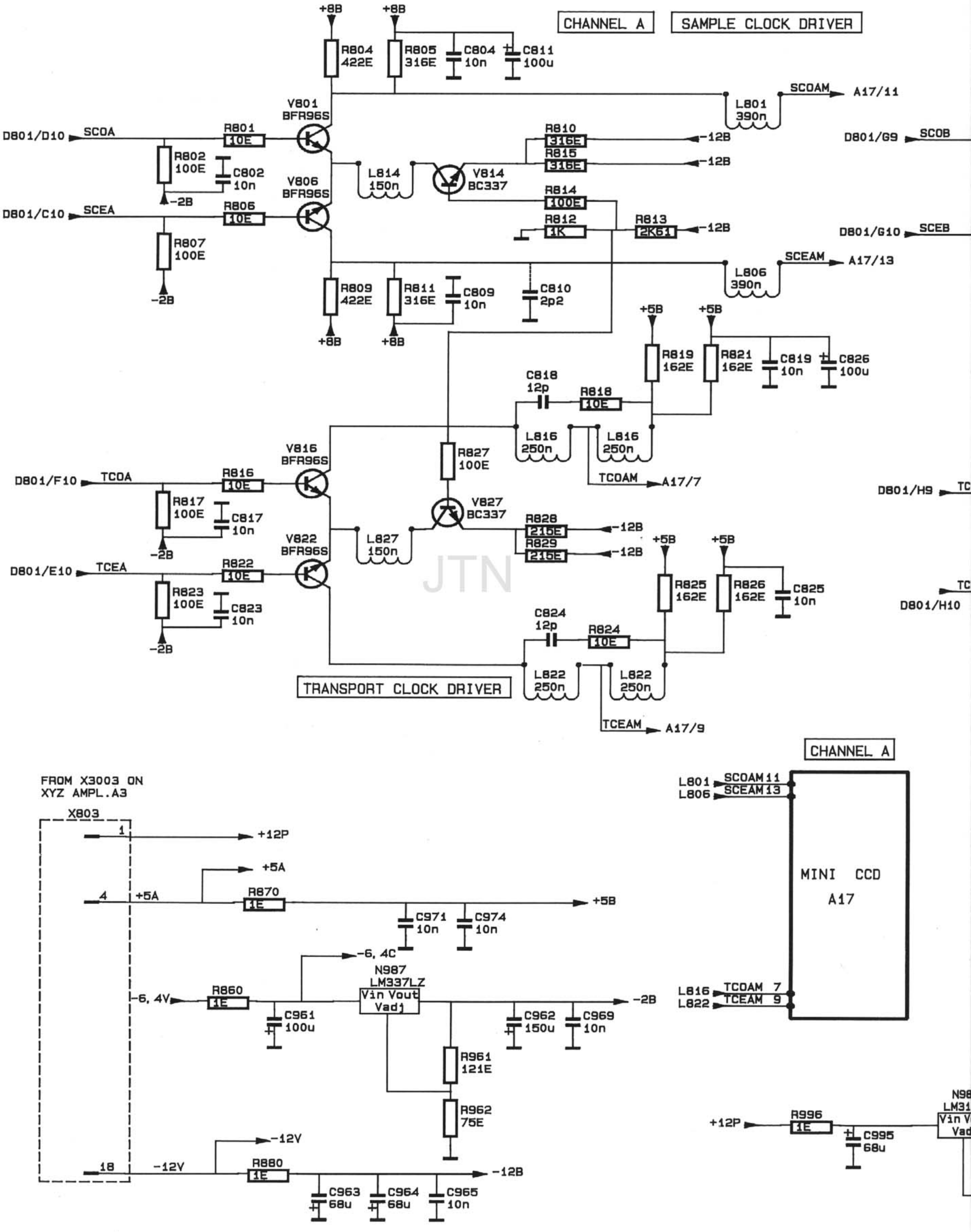
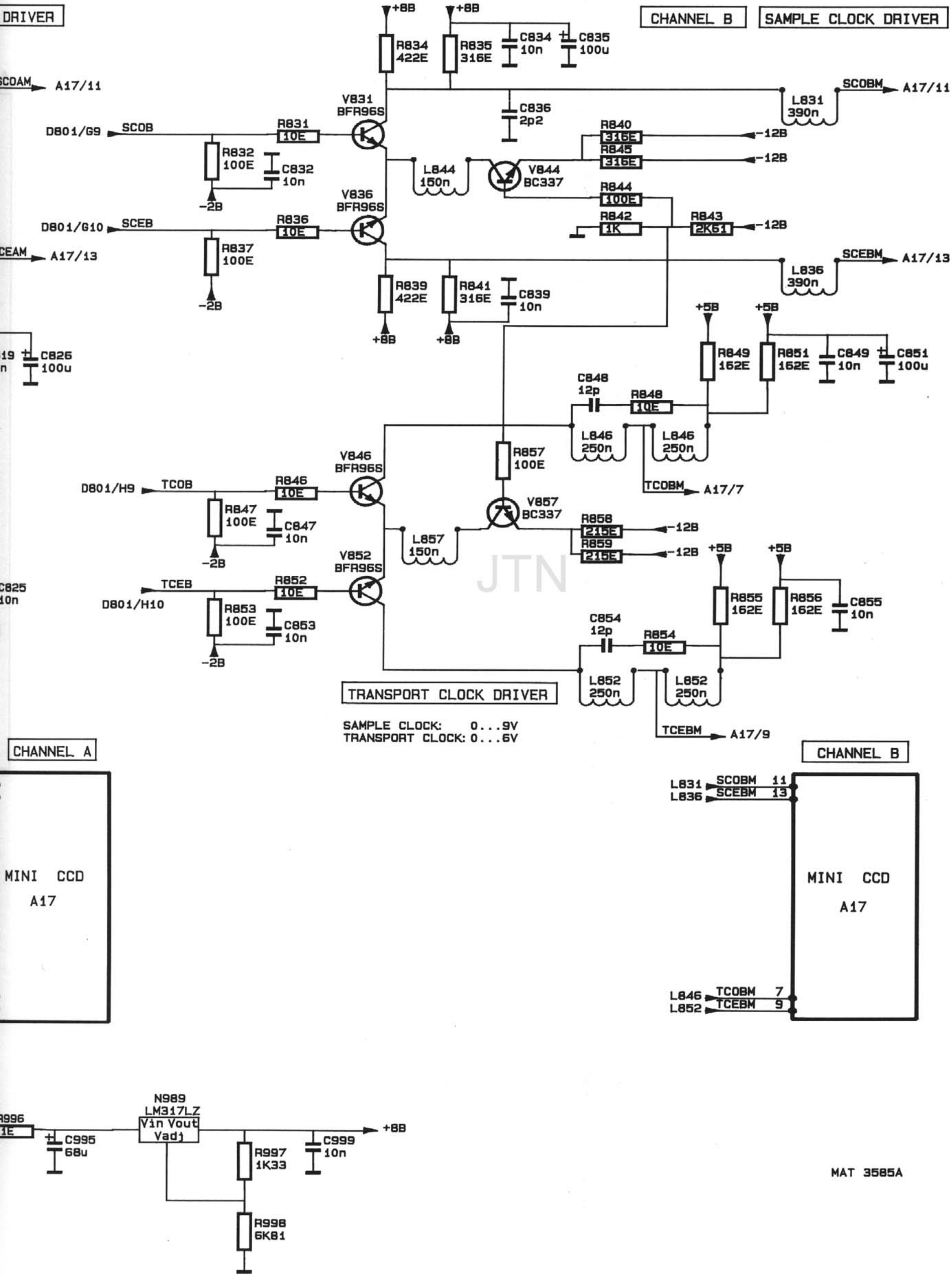
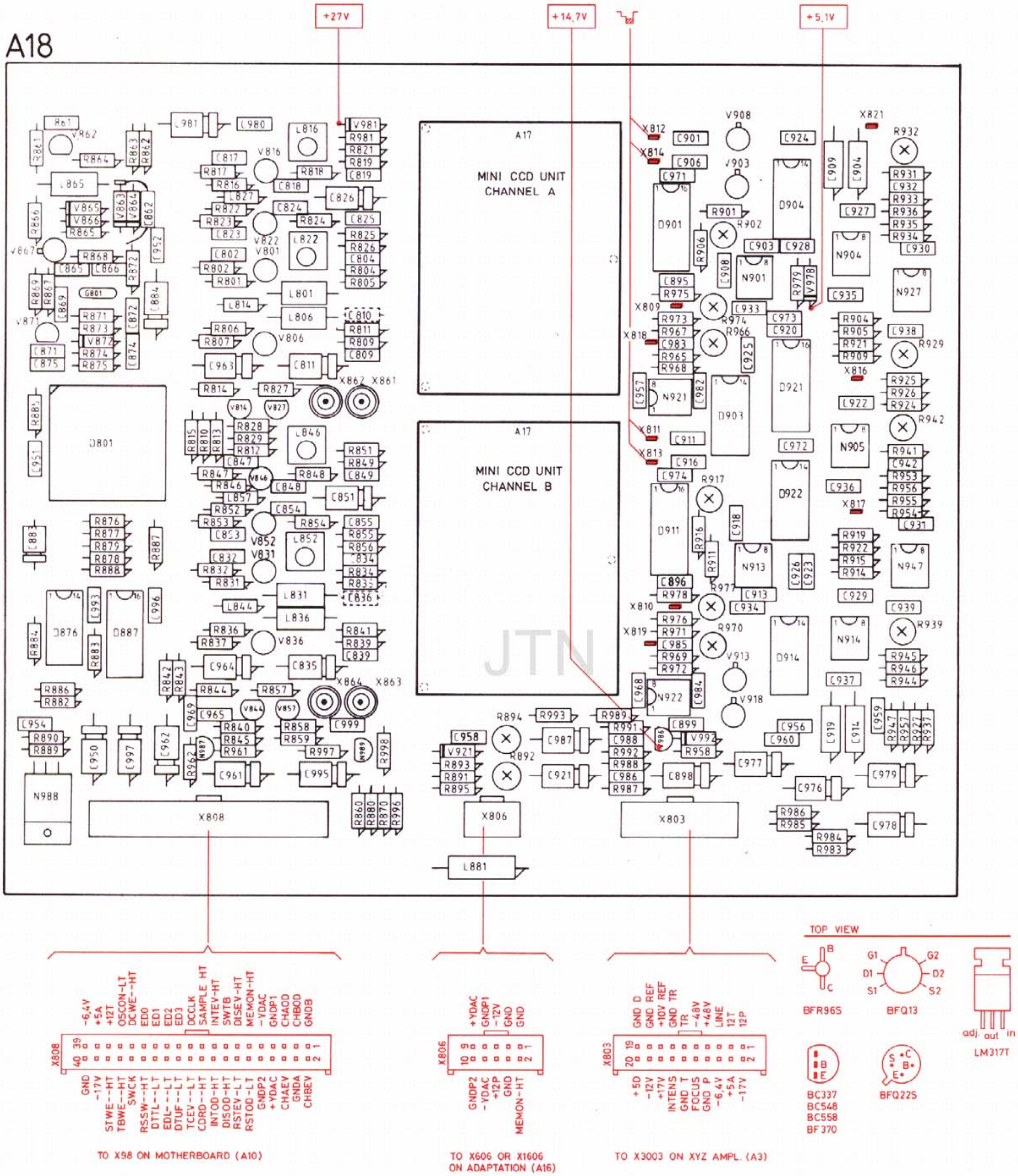


Figure 18.12 Circuit diagram of P²CCD: clock drivers


DRIVER
CHANNEL B
SAMPLE CLOCK DRIVER
SCOAM A17/11
SCEAM A17/13
D801/G9 SCOB
D801/G10 SCEB
R831 10E
R832 100E
C832 10n
R836 10E
R837 100E
-2B
V831 BFR96S
V836 BFR96S
+8B
R834 422E
R835 316E
C834 10n
C835 100u
C836 2p2
L844 150n
V844 BC337
R840 316E
R845 316E
R844 100E
R842 1K
R843 2K61
-12B
R839 422E
R841 316E
C839 10n
L831 390n
SCOBM A17/11
L836 390n
SCEBM A17/13
+5B
R849 162E
R851 162E
C849 10n
C851 100u
C826 100u
C848 12p
R848 10E
L846 250n
R857 100E
TCOBM A17/7
D801/H9 TCOB
V846 BFR96S
R846 10E
R847 100E
C847 10n
V857 BC337
L857 150n
R858 215E
R859 215E
V852 BFR96S
C825 10n
TCEB
D801/H10
R852 10E
R853 100E
C853 10n
R855 162E
R856 162E
C855 10n
C854 12p
R854 10E
L852 250n
TRANSPORT CLOCK DRIVER
SAMPLE CLOCK: 0...9V
TRANSPORT CLOCK: 0...6V
TCEBM A17/9
CHANNEL A
MINI CCD
A17
CHANNEL B
L831 SCOBM 11
L836 SCEBM 13
MINI CCD
A17
L846 TCOBM 7
L852 TCEBM 9
R996
C995 68u
N989 LM317LZ
Vin Vout
Vadj
R997 1K33
C999 10n
R998 6K81
+8B
MAT 3585A



TEST PIN	SIGNAL	ADJUSTING ELEMENT
X809	BAR (TRESHOLD) A	R974
X810	BAR (TRESHOLD) B	R977
X811	OUTAEV	R966
X812	OUTAOD	R966
X813	OUTBEV	R970
X814	OUTBOD	R970
X816	LEAKAGE A	R902
X817	LEAKAGE B	R917
X818	DC LEVEL A	R966
X819	DC LEVEL B	R970
X821	GND	- -

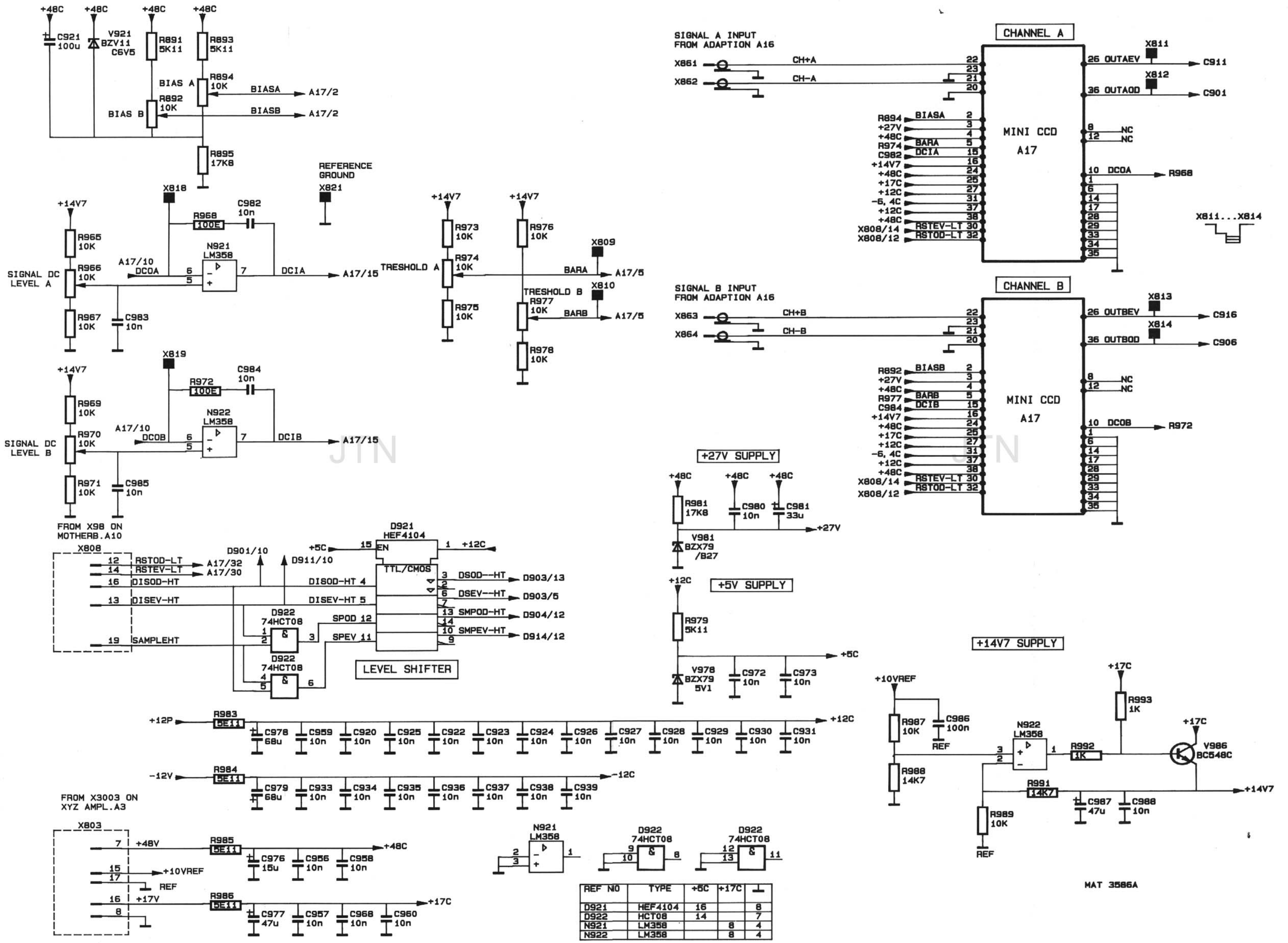
ADJUSTING ELEMENTS:	
R892	BIAS B
R894	BIAS A
R902	LEAKAGE CORRECTION
R917	LEAKAGE CORRECTION
R929	GAIN A
R932	OFFSET A
R939	GAIN B
R942	OFFSET B
R966	DC LEVEL A
R970	DC LEVEL B
R974	TRESHOLD A
R977	TRESHOLD B

50 Ω CABLE CONNECTIONS:

PIN:	SIGNAL:	DERIVED FROM:
X861	CH+A	X661 (PM3350A)
	CH+A	X1661 (PM3365A)
X862	CH-A	X662 (PM3350A)
	CH-A	X1662 (PM3365A)
X863	CH+B	X663 (PM3350A)
	CH+B	X1663 (PM3365A)
X864	CH-B	X664 (PM3350A)
	CH-B	X1664 (PM3365A)

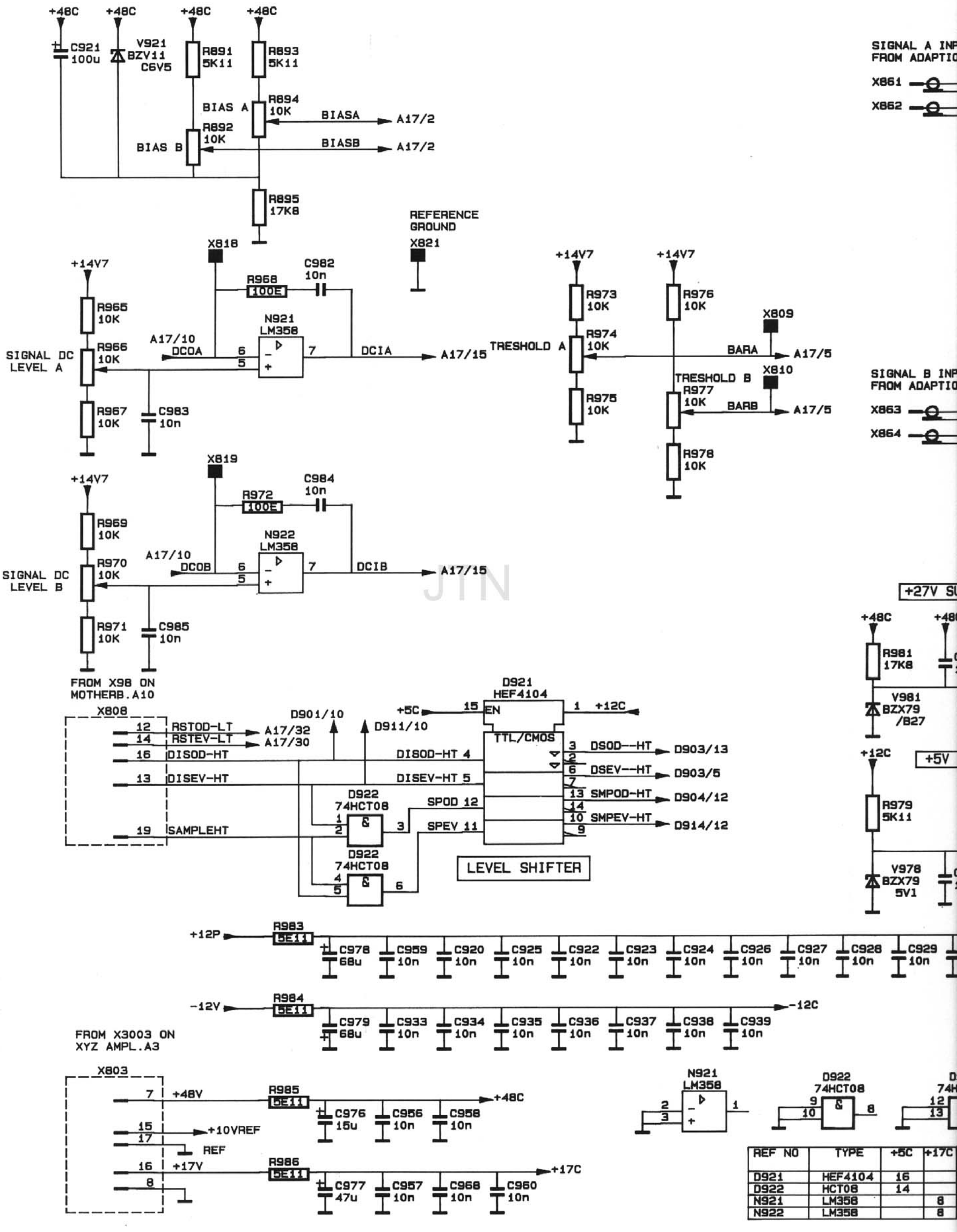
MAT3588A

Figure 18.13 P²CCD unit p.c.b.



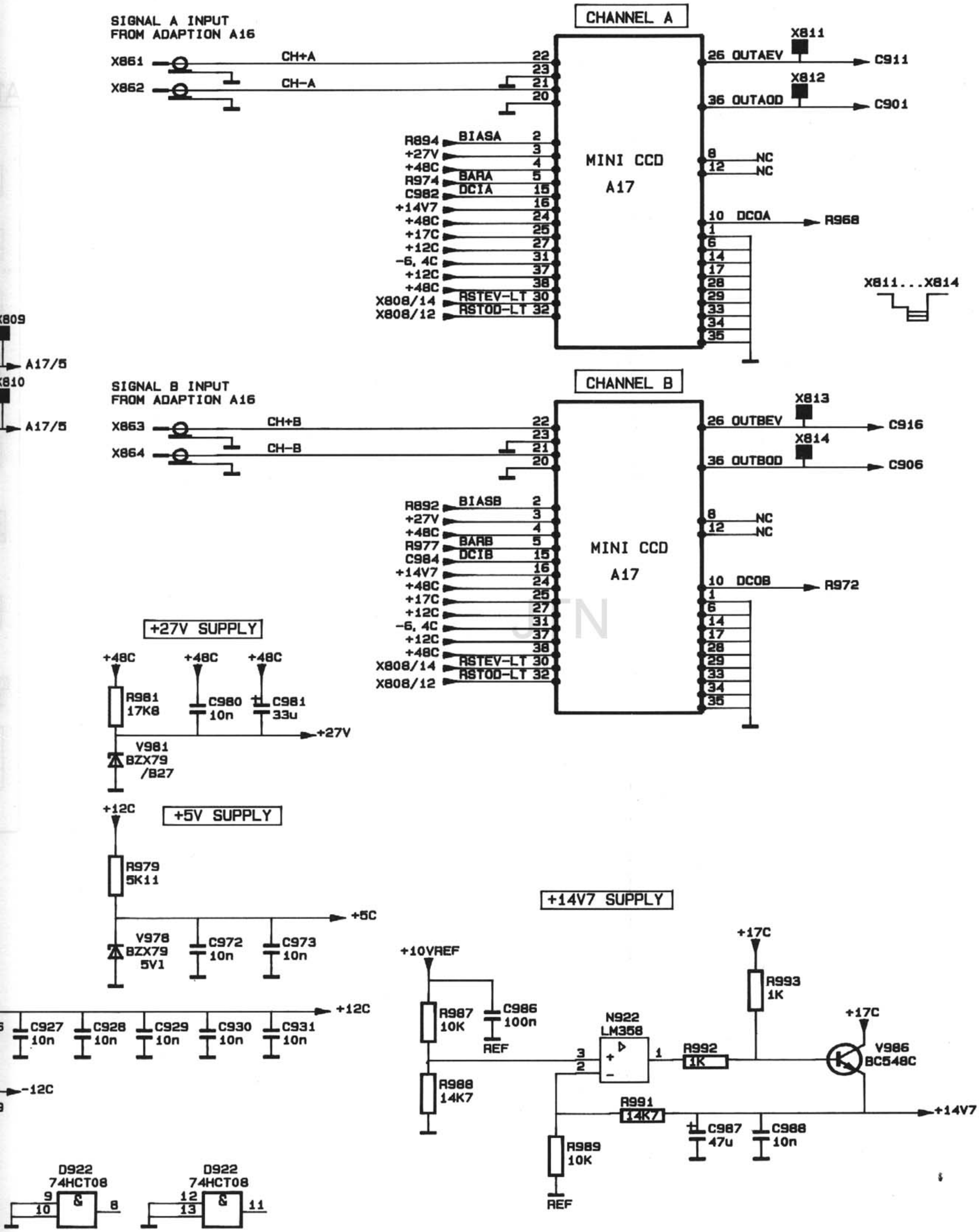
REF NO	TYPE	+5C	+17C	⊥
D921	HEF4104	16		8
D922	HCT08	14		7
N921	LM358		8	4
N922	LM358		8	4

Figure 18.14 Circuit diagram of P²CCD: part 3



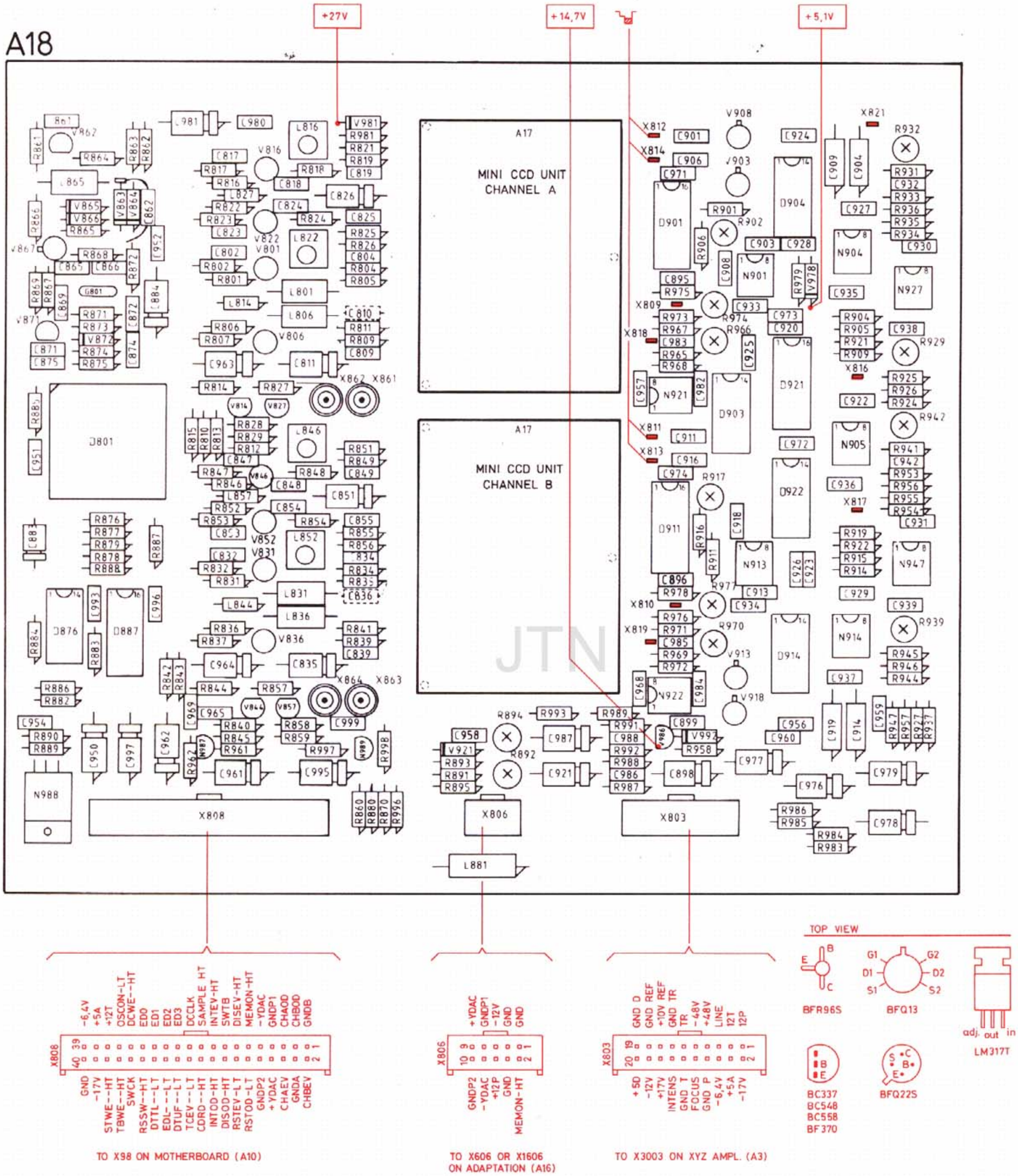
REF NO	TYPE	+5C	+17C
D921	HEF4104	16	
D922	HCT08	14	
N921	LM358		8
N922	LM358		8

Figure 18.14 Circuit diagram of P²CCD: part 3



MAT 3586A

F NO	TYPE	+5C	+17C	⊥
21	HEF4104	16		8
22	HCT08	14		7
21	LM358		8	4
22	LM358		8	4



TEST PIN	SIGNAL	ADJUSTING ELEMENT
X809	BAR (TRESHOLD) A	R974
X810	BAR (TRESHOLD) B	R977
X811	OUTAEV	R966
X812	OUTAOD	R966
X813	OUTBEV	R970
X814	OUTBOD	R970
X816	LEAKAGE A	R902
X817	LEAKAGE B	R917
X818	DC LEVEL A	R966
X819	DC LEVEL B	R970
X821	GND	- -

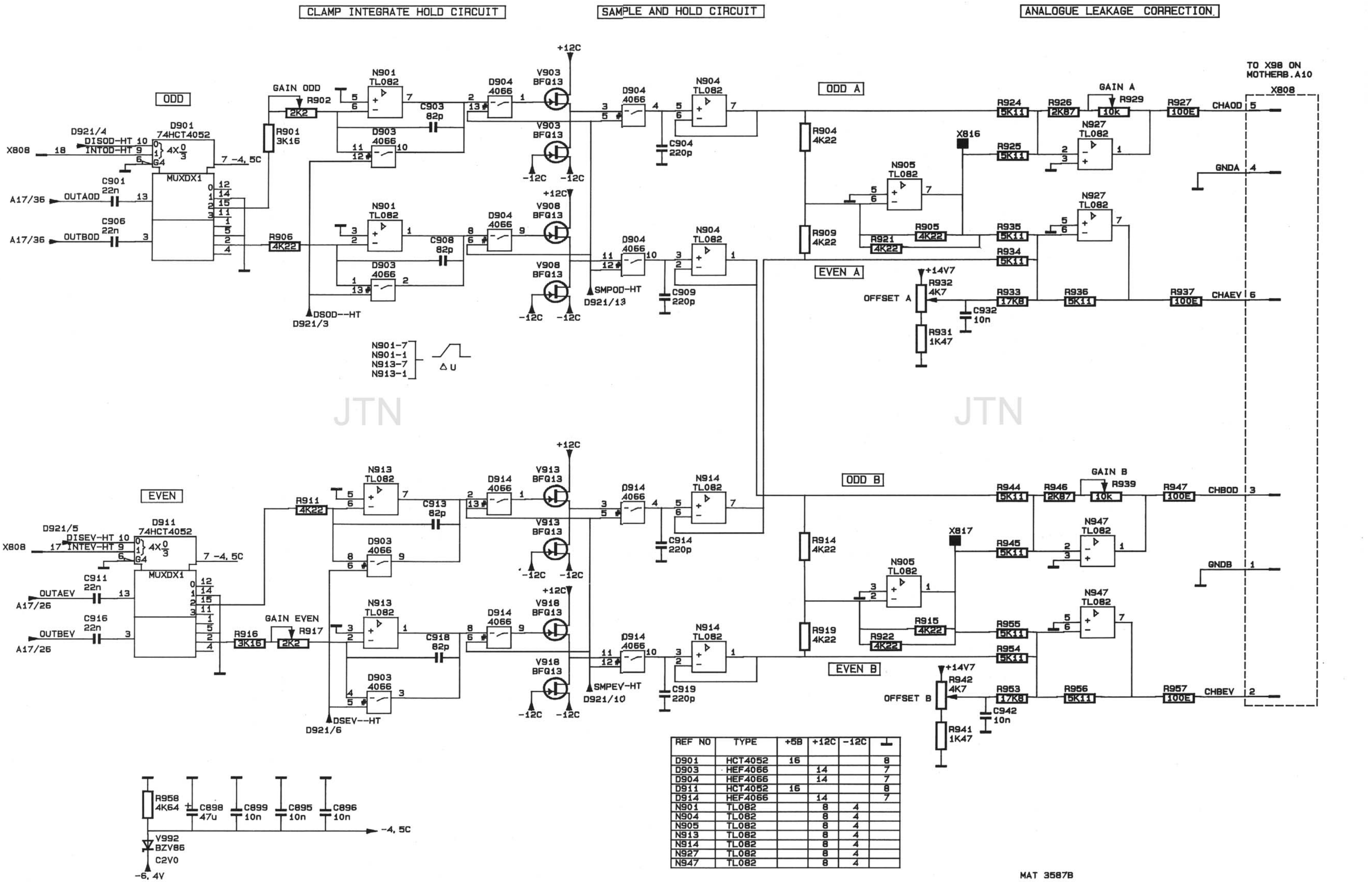
ADJUSTING ELEMENTS:	
R892	BIAS B
R894	BIAS A
R902	LEAKAGE CORRECTION
R917	LEAKAGE CORRECTION
R929	GAIN A
R932	OFFSET A
R939	GAIN B
R942	OFFSET B
R966	DC LEVEL A
R970	DC LEVEL B
R974	TRESHOLD A
R977	TRESHOLD B

50 Ω CABLE CONNECTIONS:

PIN:	SIGNAL:	DERIVED FROM:
X861	CH+A	X661 (PM3350A)
	CH+A	X1661 (PM3365A)
X862	CH−A	X662 (PM3350A)
	CH−A	X1662 (PM3365A)
X863	CH+B	X663 (PM3350A)
	CH+B	X1663 (PM3365A)
X864	CH−B	X664 (PM3350A)
	CH−B	X1664 (PM3365A)

MAT3588A

Figure 18.15 P²CCD unit p.c.b.



REF NO	TYPE	+5B	+12C	−12C	⊥
D901	HCT4052	16			8
D903	HEF4066		14		7
D904	HEF4066		14		7
D911	HCT4052	16			8
D914	HEF4066		14		7
N901	TL082		8	4	
N904	TL082		8	4	
N905	TL082		8	4	
N913	TL082		8	4	
N914	TL082		8	4	
N927	TL082		8	4	
N947	TL082		8	4	

Figure 18.16 Circuit diagram of P^2CCD: CIH circuit

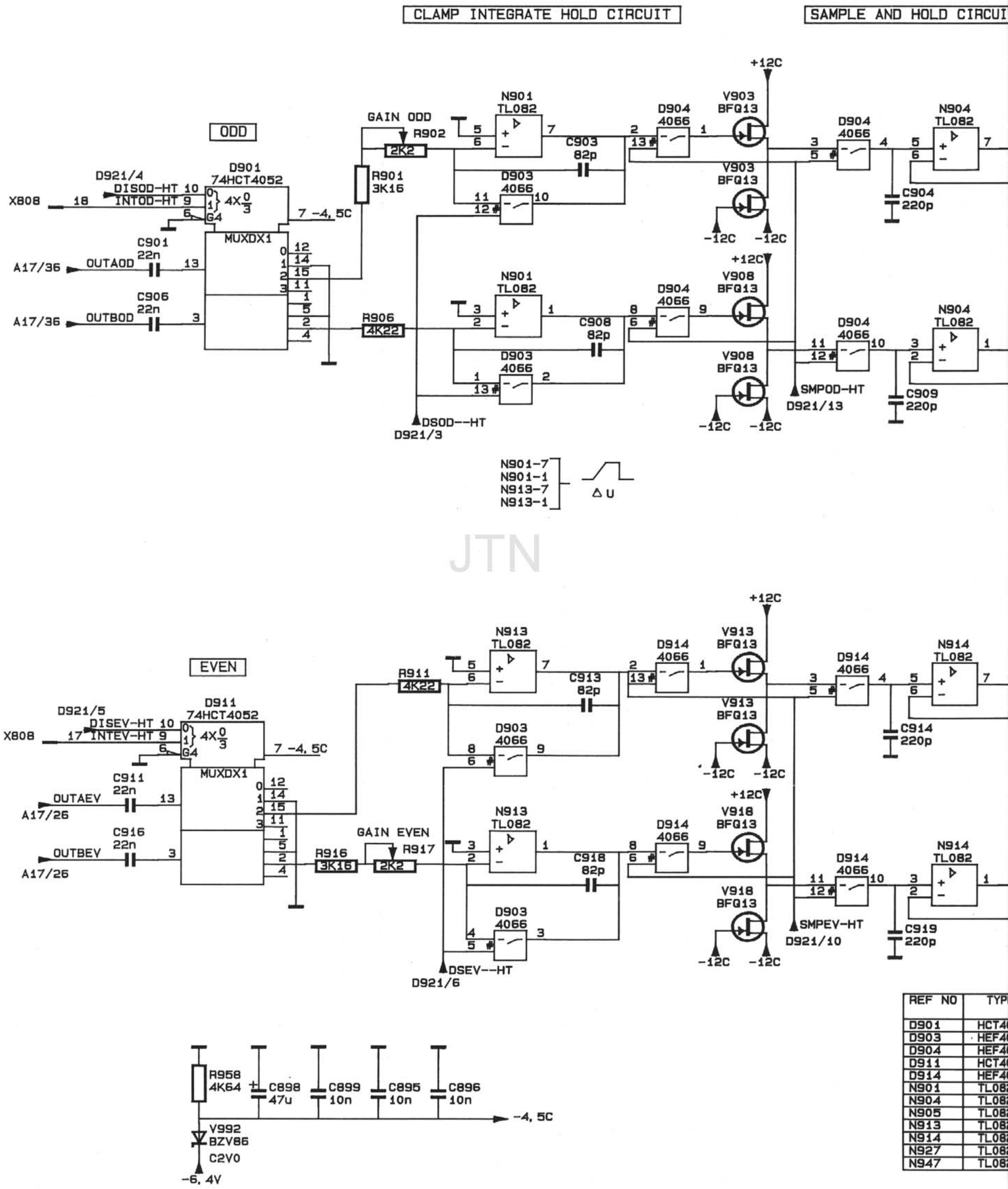
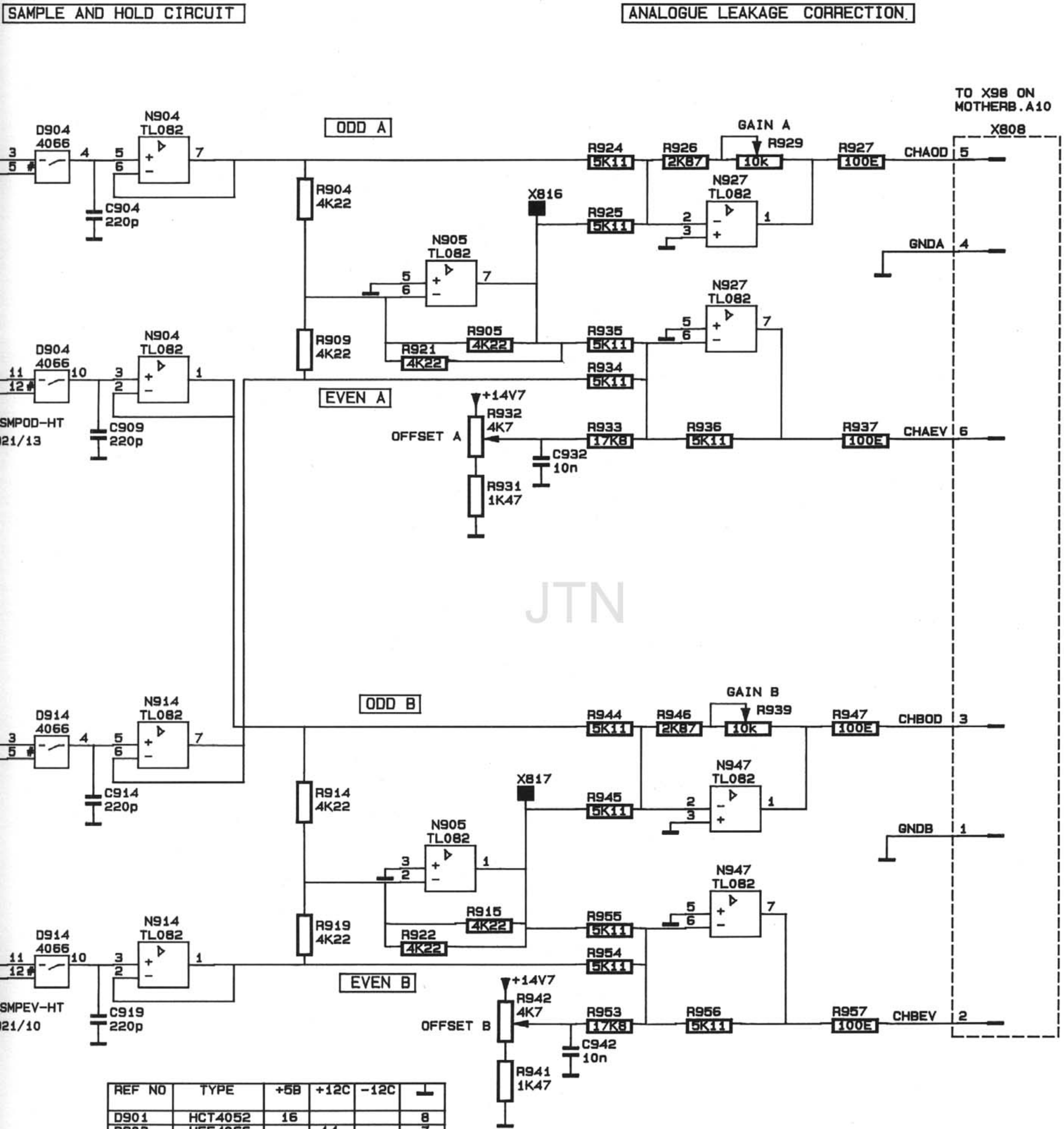


Figure 18.16 Circuit diagram of P²CCD: CIH circuit



REF NO	TYPE	+5B	+12C	−12C	⊥
D901	HCT4052	16			8
D903	HEF4066		14		7
D904	HEF4066		14		7
D911	HCT4052	16			8
D914	HEF4066		14		7
N901	TL082		8	4	
N904	TL082		8	4	
N905	TL082		8	4	
N913	TL082		8	4	
N914	TL082		8	4	
N927	TL082		8	4	
N947	TL082		8	4	

MAT 3587B

19 P²CCD UNIT (A18) - PM3355/57 ONLY!

The P²CCD unit consists of:

- The P²CCDs with associated circuits
- The ACE (Advanced Customised ECL) device with associated circuit
- The clock drivers circuits
- The CCD default circuits
- The P²CCD output circuit

19.1 P²CCDs

19.1.1 Introduction

The P²CCD (Profiled Peristaltic Charge Coupled Device) - OQ0204 - which is basically an analog shift register, consists of an ODD-side and an EVEN-side. Each side consists of a sample gate, 256 stages through which the samples can be shifted, and an output gate (see figure 19.1).

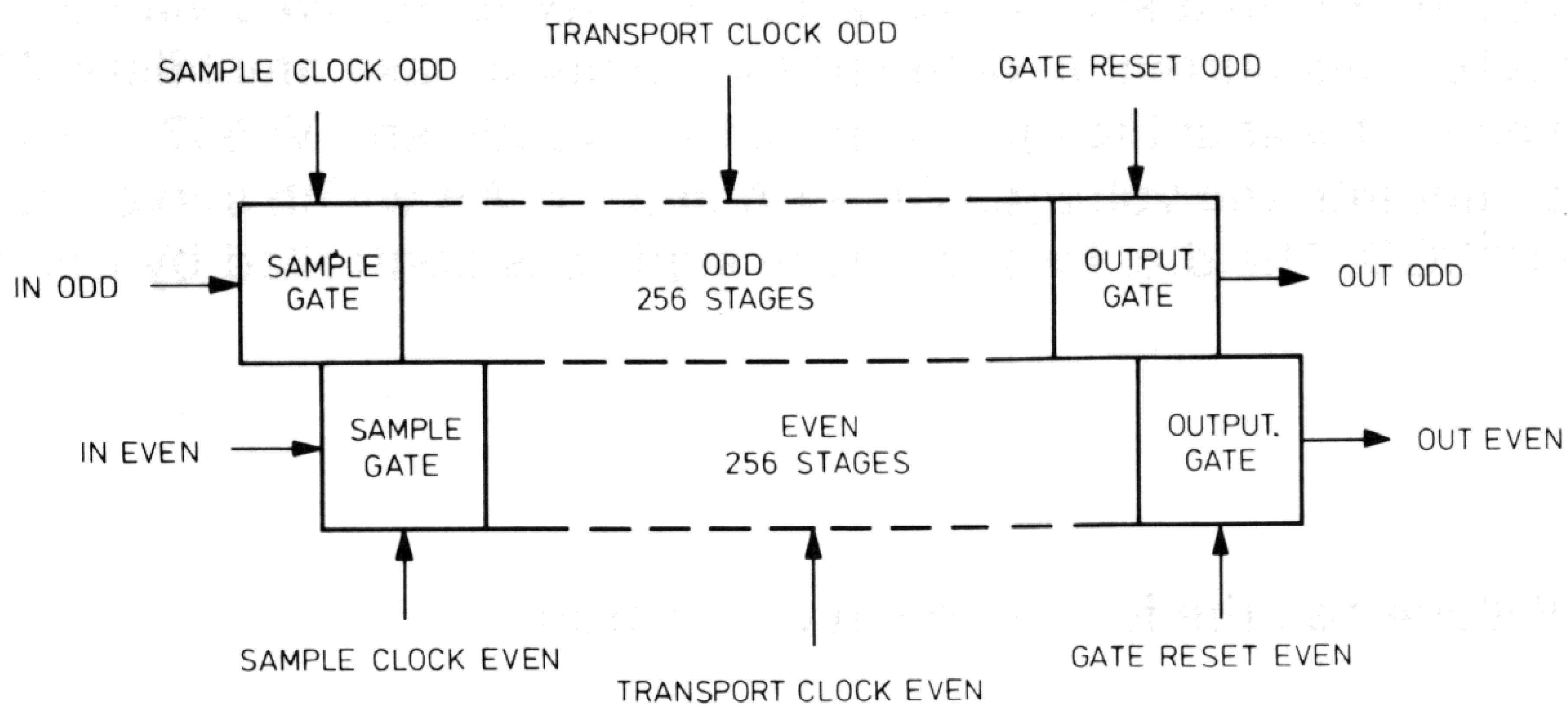


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Figure 19.1 Schematic diagram of a P²CCD circuit

The clock signals of the ODD and the EVEN side are always in anti-phase (see figure 19.2).

- On the rising edge of the sample clock, a sample of the input signal is taken.
- On the falling edge of the sample clock, this sample is shifted to the first stage
- On the falling edge of the transport clock, all samples in all stages are shifted (transferred) one stage. The last sample is transferred to the output stage. The output stage is enabled when the gate reset signal is 0 V.

The P²CCD circuit applies the samples to the Clamp, Integrate and Hold circuit (CIH circuit), which takes over the samples. Then the gate reset signal is +12 V again, which resets the output capacitor.

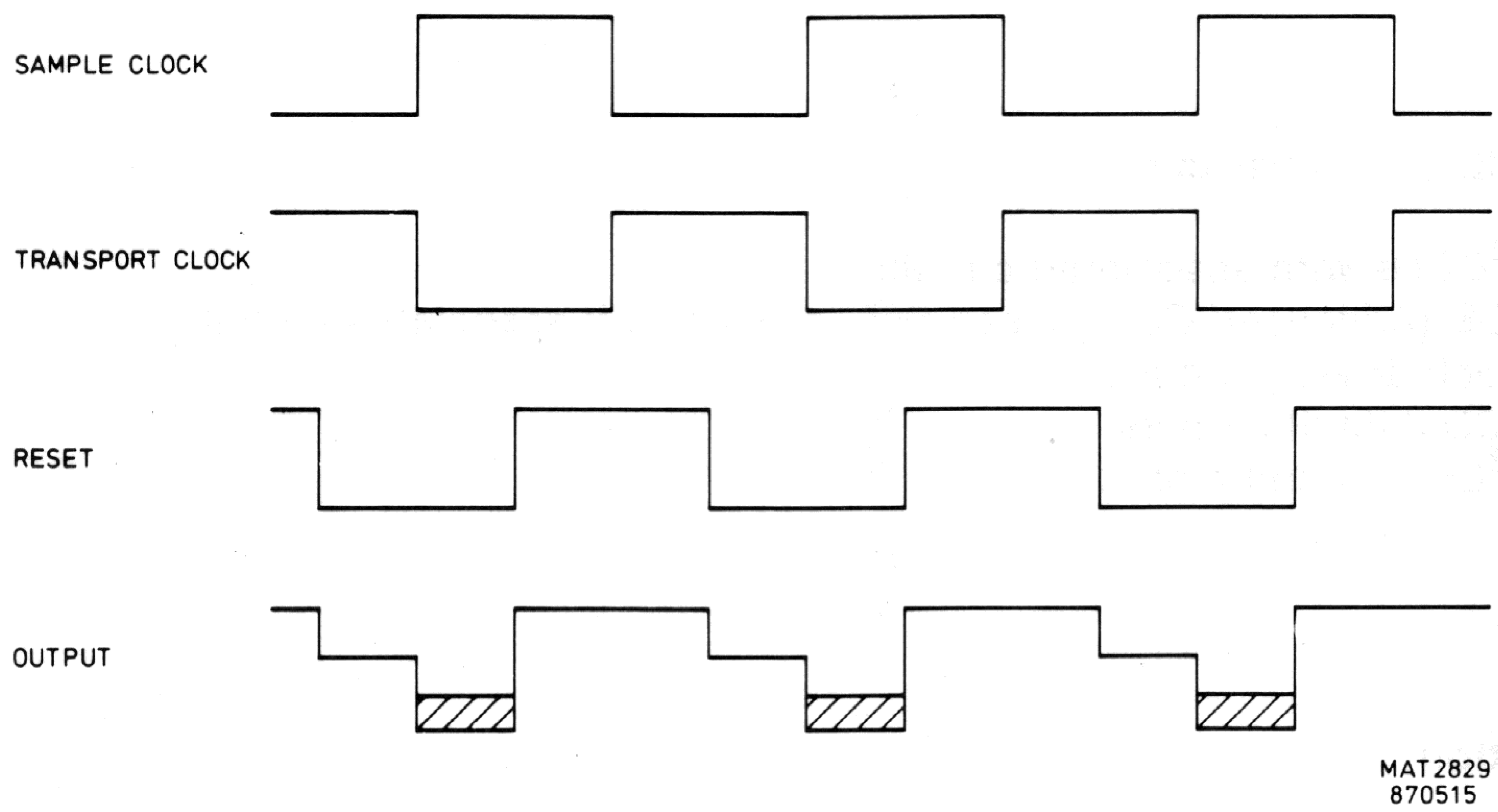


Figure 19.2 Sample and transport sequence

19.1.2 Input buffer

The differential input current with a sensitivity of 100 μA/DIV is received via 50 Ω cables from adaptation unit A16. This current is buffered by common-base amplifiers V5504 and V5503 and then applied to the shunt feedback amplifiers V5506 and V5507. This stage converts the input current into the voltages CH+AA and CH-AA which serves as the input voltage for the P^2CCD. The d.c. level of these signals is controlled by pot.meter R5527.

19.1.3 P^2CCD - OQ0204

The P^2CCD circuit OQ0204 has the following pin connectors.

Pin	Name	Description
1	INE	Same signal as SAMPLE CLOCK EVEN but d.c. shifted. The bias value of this signal can be varied by potentiometer R5604 for ch. A or R5602 for ch. B.
2	G1E	d.c. barrier voltage level. This d.c. value can be varied by potentiometer R5608 for ch. A or R5708 for ch. B.
3	G2E	Input signal, even. The input signal can be varied by potentiometer R5527 for ch. A or R5577 for ch. B.
4	G3E	SAMPLE CLOCK EVEN, takes samples of the input signal.
5	G4E	Same signal as SAMPLE CLOCK EVEN but d.c. shifted.
6	CL1IN	TRANSPORT CLOCK EVEN, transfers the samples in all 256 even stages one stage further.
7	CL2IN	Same signal as TRANSPORT CLOCK EVEN but time shifted
8	SUB	Default value of -3,9 V approx.
9	CL20	n.c.

Pin	Name	Description
10	CL10	n.c.
11	GSP	GATE SEPARATION. Default value of +3,0 V approx.
12	OUT EVEN	Output signal even.
13	DRSE	DRAIN RESET EVEN. Default value of +19,2 V approx.
14	GRE	GATE RÈSET EVEN signal. When 0 V, the even output is enabled, when +12 V, the even output is disabled.
15	GRO	GATE RESET ODD signal. When 0 V, the odd output is enabled, when +12 V, the odd output is disabled.
16	DRSO	DRAIN RESET ODD. Default value of +19,2 approx.
17	OUT ODD	Output signal odd.
18	DSFS	Supply voltage of +25 V.
19	CL30	n.c.
20	CL40	n.c.
21	SUB	Default value of -3,9 V approx.
22	CL4IN	Same signal as TRANSPORT CLOCK ODD but time shifted.
23	CL3IN	TRANSPORT CLOCK ODD, transfers the samples in all 256 odd stages one stage further.
24	G40	Same signal as SAMPLE CLOCK ODD but d.c. shifted.
25	G30	SAMPLE CLOCK ODD, takes samples of the input signal.
26	G20	Input voltage, odd. The input signal can be varied by potentiometer R5527 for ch. A or R5577 for ch. B.
27	G10	d.c. barrier voltage level. This d.c. value can be varied by potentiometer R5608 for ch. A or R5708 for ch. B.
28	INO	Same signal as SAMPLE CLOCK ODD but d.c. shifted. The bias value of this signal can be varied by potentiometer R5604 for ch. A or R5602 for ch. B.

The output signals are buffered by emitter-followers V5672 (V5772) for EVEN and V5671 (V5771) for ODD.

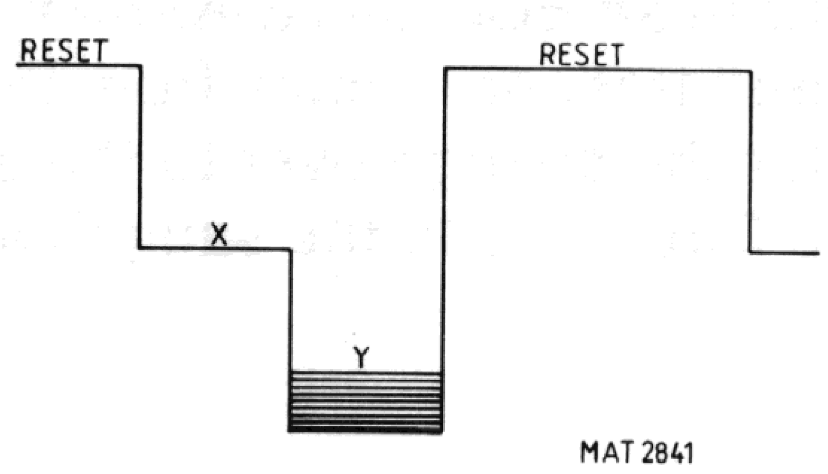


Figure 19.3 Output signal

While the output stage of the P^2CCD is reset by the GRE signal (for even samples, or GRO for odd samples) its output voltage is about 19,2 V. This voltage is determined by a resistor divider network at the DRSE input (pin 13 of the P^2CCD).
When the RESET is removed, the output drops to an undefined level X. On the falling edge of the transport clock, the sample leaves the output stage of the P^2CCD. Now the output voltage drops to level Y. The voltage difference between level X and level Y represents the value of the sample.
This voltage difference is detected by the input of the CIH circuit (see section 19.5).

The following table gives a list of sample clock frequencies and the slower read-out frequencies for all time-base positions (P = P^2CCD mode, D = Direct mode, R = Roll mode).

TIME/DIV	mode	sample clock freq.	read-out freq.
0,2 μs	P	125 MHz	50 kHz
0,5 μs	P	50 MHz	50 kHz
1 μs	P	25 MHz	50 kHz
2 μs	P	12,5 MHz	50 kHz
5 μs	P	5 MHz	50 kHz
10 μs	P	2,5 MHz	50 kHz
20 μs	P	1,25 MHz	50 kHz
50 μs	P	500 kHz	50 kHz
0,1 ms	P	250 kHz	50 kHz
0,2 ms	P	125 kHz	50 kHz
0,5 ms	D1	50 kHz	50 kHz
1 ms	D1	50 kHz	50 kHz
2 ms	D1	50 kHz	50 kHz
5 ms	D2	40 kHz	40 kHz
10 ms	D2	40 kHz	40 kHz
20 ms	D2	40 kHz	40 kHz
50 ms	D2	40 kHz	40 kHz
0,1 s	D2	40 kHz	40 kHz
0,2 s	D2	40 kHz	40 kHz
0,5 s	D2	40 kHz	40 kHz
1 s	R	40 kHz	40 kHz
2 s	R	40 kHz	40 kHz
5 s	R	40 kHz	40 kHz
10 s	R	40 kHz	40 kHz
20 s	R	40 kHz	40 kHz
50 s	R	40 kHz	40 kHz

Note: *In P and D1 mode (time-base settings: 0,2 μs/div...2 ms/div), the P^2CCDs act as time converters: the read-in frequency is higher then the read-out frequency. In D2 and R mode (time-base settings: 5 ms/div...0,5s/div), the P^2CCDs act as analog shift registers: the read-in frequency is the same as the read-out frequency.*

19.2 ACE (ADVANCED CUSTOMISED ECL)

The CCD logic and fast time-base divider are integrated in an ECL-GATE-ARRAY D801. It contains various fast dividers to generate the sample and transport clock from the FCH and FCL signals in P-mode. It also contains the logic for the change over to the slow clock (SWCK) for the read out stroke in P-mode. In the Direct mode the sample and transport clocks are derived from SWTB.

In D-mode, the sample and transport clock has a clock-frequency of 50 kHz (D1 mode) or 40 kHz (D2 mode). These frequencies are derived from signal SWCK (100 kHz in D1 mode and 80 kHz in D2 mode).

In P-mode the delay counter indicates the moment when the P^2CCD is read. The delay counter consists of a 4-bit presetable counter internal in the ECL-GATE-ARRAY and a 16-bit external counter D441 .. D446 (on unit A14).

The output lines are at ECL level (-0,9 V...-1,7 V).
The output signals TCEV, CDRD, DTUF and DCC are buffered and converted into a TTL level.

19.3 FAST CLOCK OSCILLATORS

The digital time-base generator in P-mode is driven by a 100 MHz or 125 MHz crystal oscillator. The 100 MHz oscillator is active in the time-base settings 0,2 ms ... 0,5 μs, the 125 MHz oscillator is only active in time-base setting 0,2 μs. The oscillators can be switched-on and -off by the signals EN100-LT and EN125-LT. Since both oscillators are identical, only the 100 MHz oscillator is described.
When EN100-LT is low, V5101 and thus zener V5102 are conducting. This causes a d.c. level of 3,6 V on the base of V5104 sothat crystal G5101 starts to oscillate. The 100 MHz resonance circuit around this crystal is formed by L5101, C5103 and C5104. This signal is applied to the input of the frequency doubler.
The input transistor, V5121, is set in class C, so the 100 MHz (or 125 MHz) signal is distorted. The second harmonic is then filtered. This is done by the circuit formed by L5121 and C5123...5128. Note that trimmer C5128 is only in circuit when EN100-LT is low (200 MHz). Finally, the filtered signal with a frequency of 200 MHz or 250 MHz is buffered by V5131 and V5132 and applied to the ACE. The amplitude of this signal is 1 V(p-p).
To keep the output amplitude constant, this signal is fed-back to the input of the frequency doubler via N5101.

19.4 CLOCK DRIVERS

Each SAMPLE AND TRANSPORT clock driver consists of two transistors with a current source. To increase the bandwidth of the signal, a coil is added between the collector and the gate capacitance of the PCCD; all clock drivers are buffered by a bridged T-network. For timing reasons in the transport gates, TCEAM2 and TCEOAM2 has to be delayed to transport clocks TCEAM1 and TCOAM1. This is done by using a 2 ns delay network (LC circuit) which is a part of the pcb.

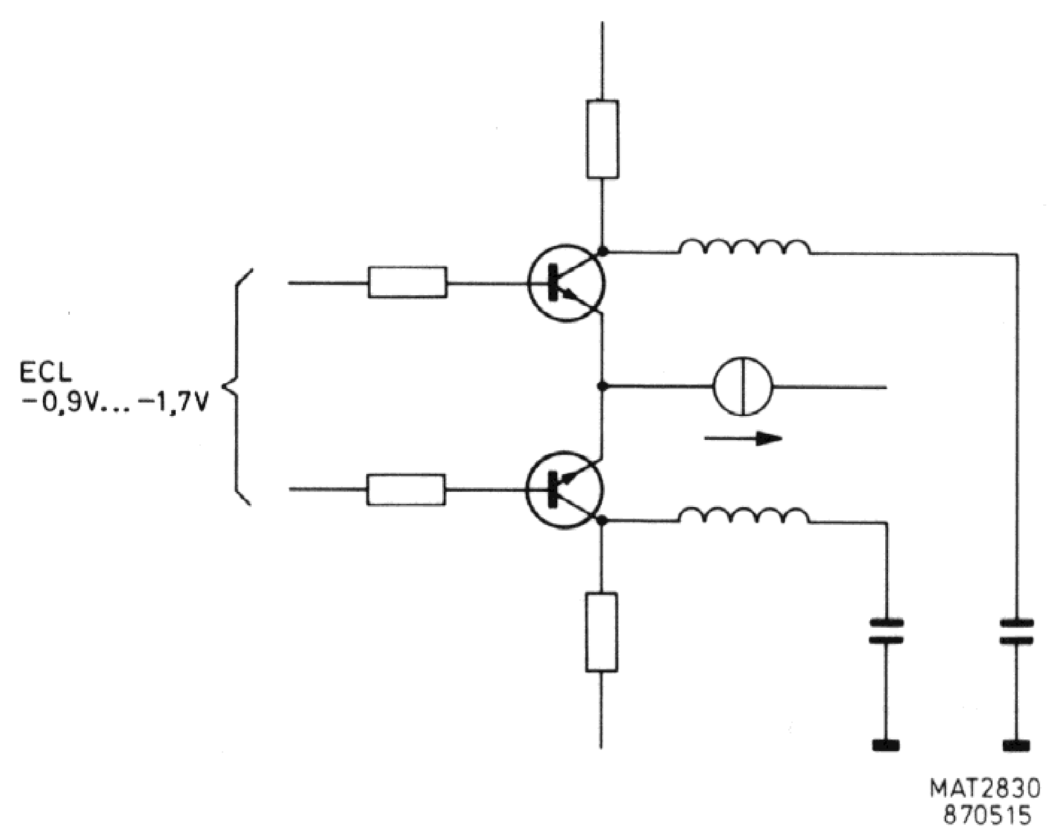


Figure 19.4 Principle of the sample clock drivers

The inputs are at ECL level (-0,9 V...-1,7 V) and are derived from the ACE. These are converted into a 0 ... 9 V signal for the sample clock drivers or 0...6 V signal for the transport clock drivers.

19.5 P²CCD OUTPUT

19.5.1 Level shifter

The level shifter D921 converts the TTL signals DISOD-HT, DISEV-HT, SPOD and SPEV into the same signals but at CMOS level (signal between 0... + 12 V). The sample signal SAMPLEHT is split up into a sample Odd or sample Even signal by D922.

19.5.2 Clamp Intergrate Hold circuit

The P²CCD output circuit consists of 4 CIH (Clamp Integrate Hold) circuits, followed by the analog leakage correction.

Since channel A and B are identical (and the even and odd side of each channel are identical) only channel A odd side of the CIH is described.

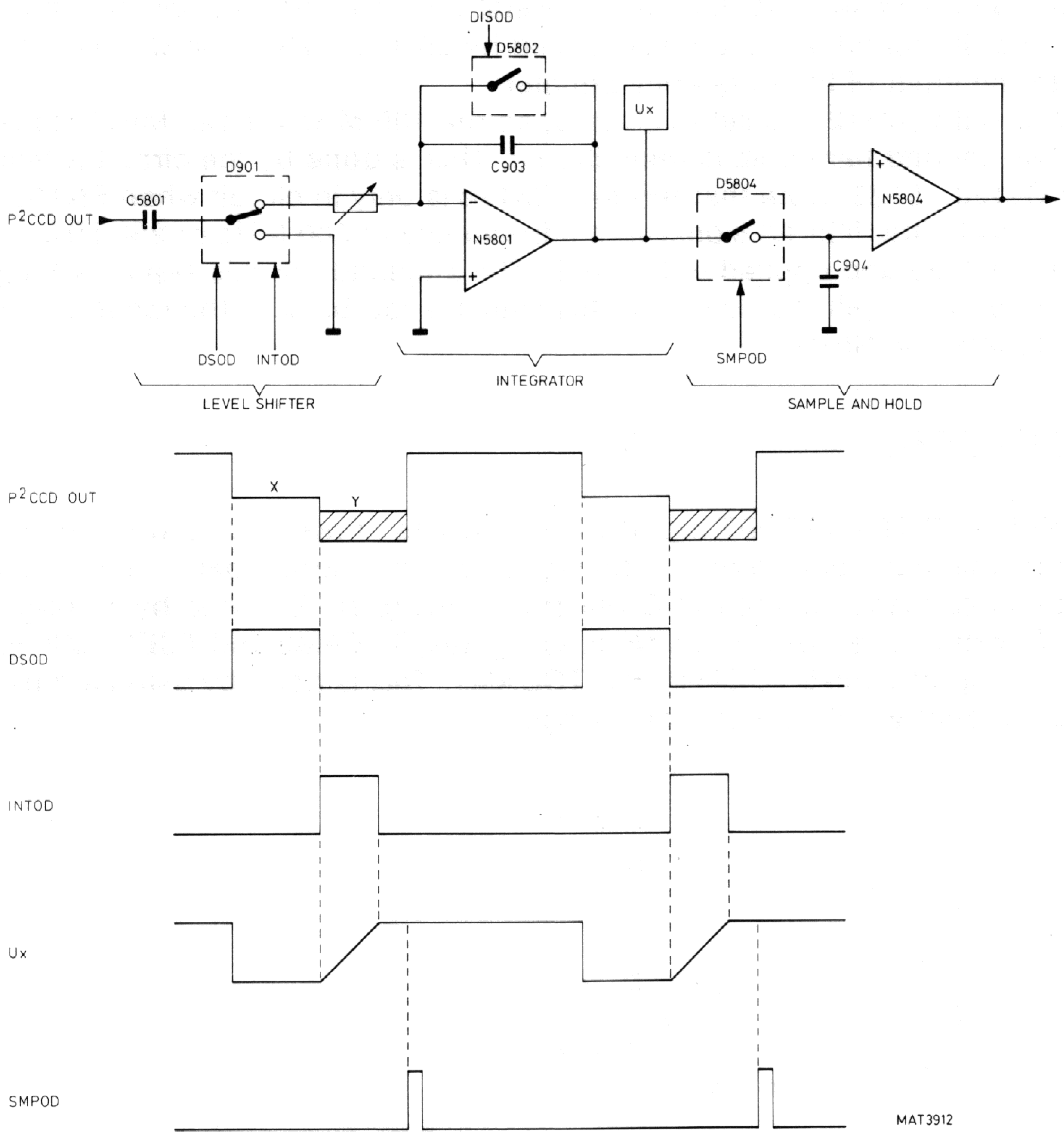


Figure 19.5 CIH circuit

The CIH receives its signal from the P²CCD.
The first stage is multiplexer D901, which serves as a level shifter. D901 detects the voltage difference between level X and Y which represents the value of the sample and sets the voltage reference level X to 0 V. When DSOD is high, capacitor C5801 is clamped to ground and charged to the voltage X. Then, when INTOD is high, capacitor C5801 passes this d.c. sample voltage Y-X to the next stage.

The second stage, integrator N5801 has two functions: it filters and amplifies the sample voltage. During the time that INTOD is high the sample voltage is present and the output of N5801 is rising linearly. Then when INTOD is low again, the output of N5801 gives a constant voltage. Next, when DISOD is high capacitor C5803 is short-circuited by D5803 and is discharged so that it is ready for a new cycle. The output of this stage is buffered by a dual FET V5803.

The third stage is the sample and hold circuit D5804. The constant output voltage of the previous stage charges the hold capacitor C5804 during the time that SMPOD is high. If SMPOD is low, the capacitor C5804 is isolated from the second stage and holds its charge; the output voltage of N5804 is now constant.

The outputs of the odd and even signals of ch. A (B) are applied to the analog leakage correction.

19.5.3 Analog leakage correction

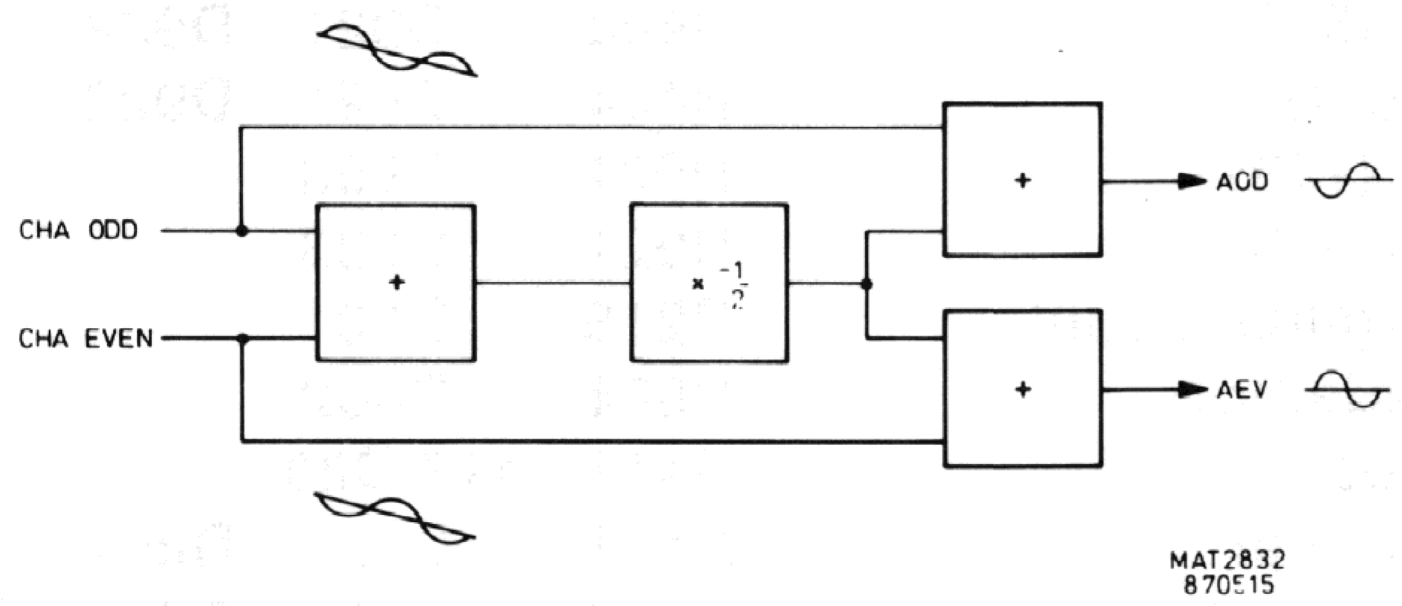


Figure 19.6 Analog leakage correction

The two samples CH.A ODD and CH.A EVEN contain the samples with a certain analog common leakage. The odd and even signals are in anti-phase while the leakage is in phase. The circuit can be split into three phases:

- Adding of both signals by R5804 and R5809. This results in a double leakage signal on N5827-2.
- Amplification by -1/2 by N5827. The result is a pure leakage signal on N5827-1.
- Adding the pure leakage signal to the ch. A odd (or: ch. A even) signal by N5847 (N5827). This results in the CHAOD and CHAEV signals.

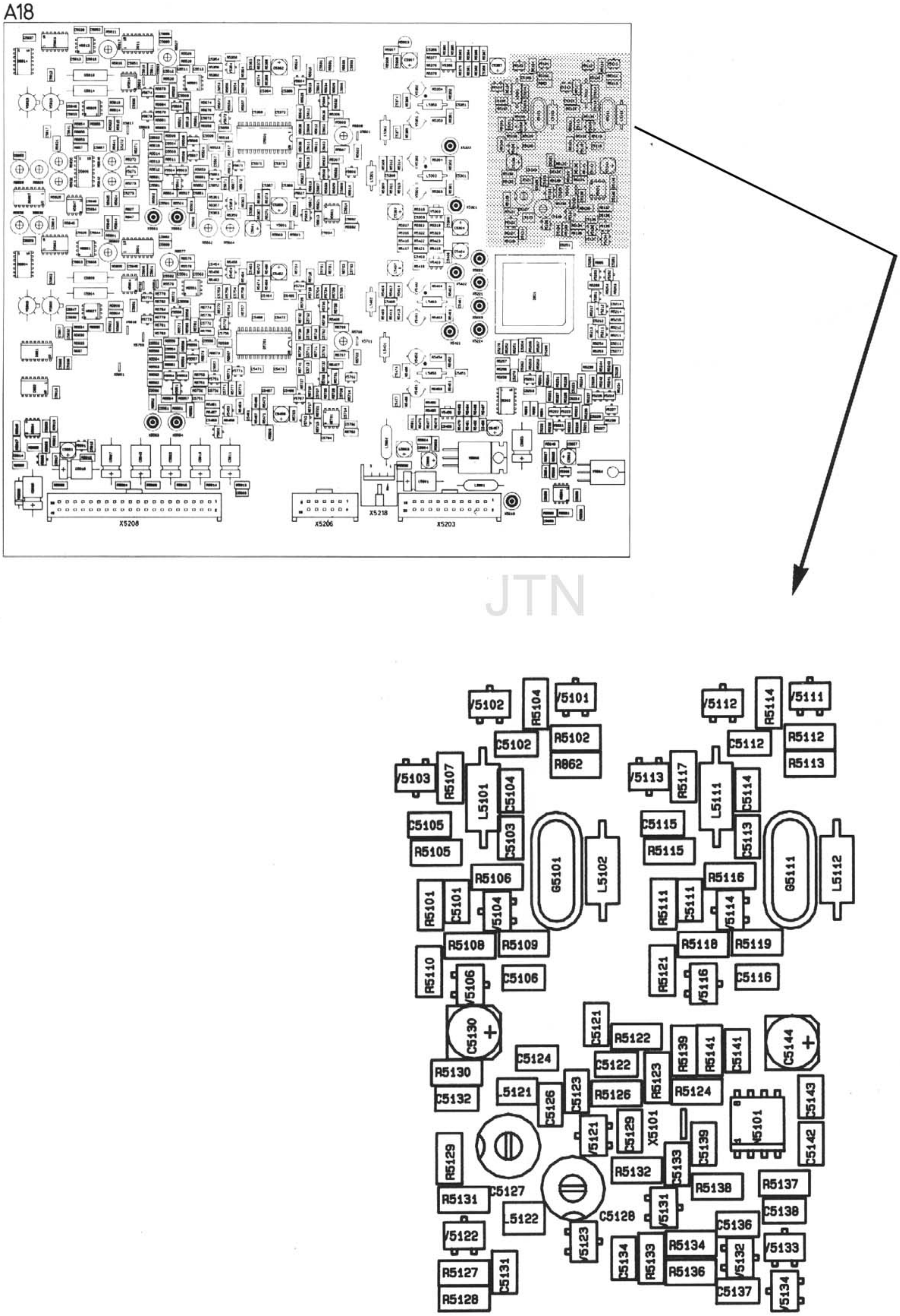
In this way, the final samples CHAOD and CHAEV are corrected for leakage. These samples are applied to the ADC circuit on unit A15.

19.6 SIGNAL NAME LIST

Signal name	Description	Signal source	Signal destination(s)
BARA	Barriër ch. A	R974	R760 - R770
BARA	Barriër ch. A	R974	R760 - R770
BARB	Barriër ch. B	R977	R760 - R770
BIASA	Bias voltage ch. A	R894	N701
BIASB	Bias voltage ch. B	R892	N701
CDRD-HT	CCD read	R883	D406 - D411
CH+A	Channel +A input	V616	R702
CH-A	Channel -A input	V617	R707
CH+B	Channel +B input	V622	R702
CH-B	Channel -B input	V621	R701
CHAOD	Channel A odd signal	R927	R501
CHAEV	Channel A even signal	R937	R502
CHBOD	Channel B odd signal	R947	R508
CHBEV	Channel B even signal	R957	R509
DCCLK	Delay counter clock	R886	D218
DCIA	DC level in ch. A	N921	R715
DCIB	DC level in ch. B	N922	R715
DCOA	DC level out ch. A	R717/718	R968
DCOB	DC level out ch. B	R717/718	R972
DCWE-HT	Delay counter write	D316	D801
DISEV-HT	Discharge even (5V)	R403	D921 - D922
DISOD-HT	Discharge odd (5V)	R404	D921 - D922
DSEV-HT	Discharge even (12V)	D921	D903
DSOD-HT	Discharge odd (12V)	D921	D903
DTTC-LT	Delay trigger terminal count	D218	D801
DTUF-HT	Delay trigger underflow	R884	D402
ED0...3	Buffered data bus	R413...417	D801
EDC--LT	Enable delay counter	R401	D221 - D801
EN100-LT	Enable P-mode/100 MHz	D313	D407 - D801 - D5202 R862 - R5128
EN125-LT	Enable P-mode/125 MHz	D313	D407 - D5202 - R5113
FCH	Fast clock high	R874	D801
FCL	Fast clock low	R875	D801
INTEV-HT	Integrate even	R411	D911
INTOD-HT	Integrate odd	R409	D901
OUTAEV	Output ch. A even	V736	D911
OUTAOD	Output ch A odd	V766	D901
OUTBEV	Output ch. A even	V736	D911
OUTBOD	Output ch. B odd	V766	D901
RSSW	Reset slow clock	R407	D801
RSTEV-LT	Reset even	R407	R751
RSTOD-LT	Reset odd	R406	R781
SAMPLEHT	Sample clock	R408	D922
SCEA	Sample clock even ch. A	D801	R806
SCEAM	Sample clock even ch. A	L806	D731
SCEB	Sample clock even ch. B	D801	R836
SCEBM	Sample clock even ch. B	L836	D731
SCOA	Sample clock odd ch. A	D801	R801
SCOAM	Sample clock odd ch. A	L801	D731
SCOB	Sample cleck odd ch. B	D801	R831
SCOBM	Sample clock odd ch. B	L831	D731

Signal name	Description	Signal source:	Signal destination(s):
SMPEV-HT	Sample even	D921	D914
SMPOD-HT	Sample odd	D921	D904
STWE-HT	Status write	D316	D801
SWCK	Slow clock	D412	D801
SWTB	Slow time base	D218	D801 - D412
TBWE-HT	Time base write	D316	D801
TCEA	Transport clock even ch. A	D801	R822
TCEAM	Transport clock even ch. A	L822	D731 - R747
TCEB	Transport clock even ch. B	D801	R852
TCEBM	Transport clock even ch. B	L852	D731 - R747
TCEV-LT	Transport clock even	R882	D401 - D408 - D411
TCOA	Transport clock odd ch. A	D801	R816
TCOAM	Transport clock odd ch. A	L816	D731 - R777
TCOB	Transport clock odd ch. B	D801	R846
TCOBM	Transport clock odd ch. B	L846	D731 - R777

A18


X5208
X5206
X5218
X5203
V5102
R5104
V5101
V5112
R5114
V5111
C5102
R5102
R862
C5112
R5112
R5113
V5103
R5107
L5101
C5104
V5113
R5117
L5111
C5114
C5105
C5103
C5115
C5113
R5105
R5115
R5106
G5101
L5102
R5116
G5111
L5112
R5101
C5101
V5104
R5111
C5111
V5114
R5108
R5109
R5118
R5119
R5110
V5106
C5106
R5121
V5116
C5116
C5130
C5121
R5122
C5144
R5139
R5141
C5141
C5124
C5122
R5123
R5130
R5124
C5143
L5121
C5126
C5123
R5126
C5132
V5121
C5129
X5101
C5139
N5101
R5129
C5142
R5132
C5133
R5138
R5137
C5127
R5131
V5131
C5138
L5122
C5128
C5136
V5122
V5123
R5134
V5133
C5134
R5133
V5132
R5127
C5131
R5136
R5128
C5137
V5134

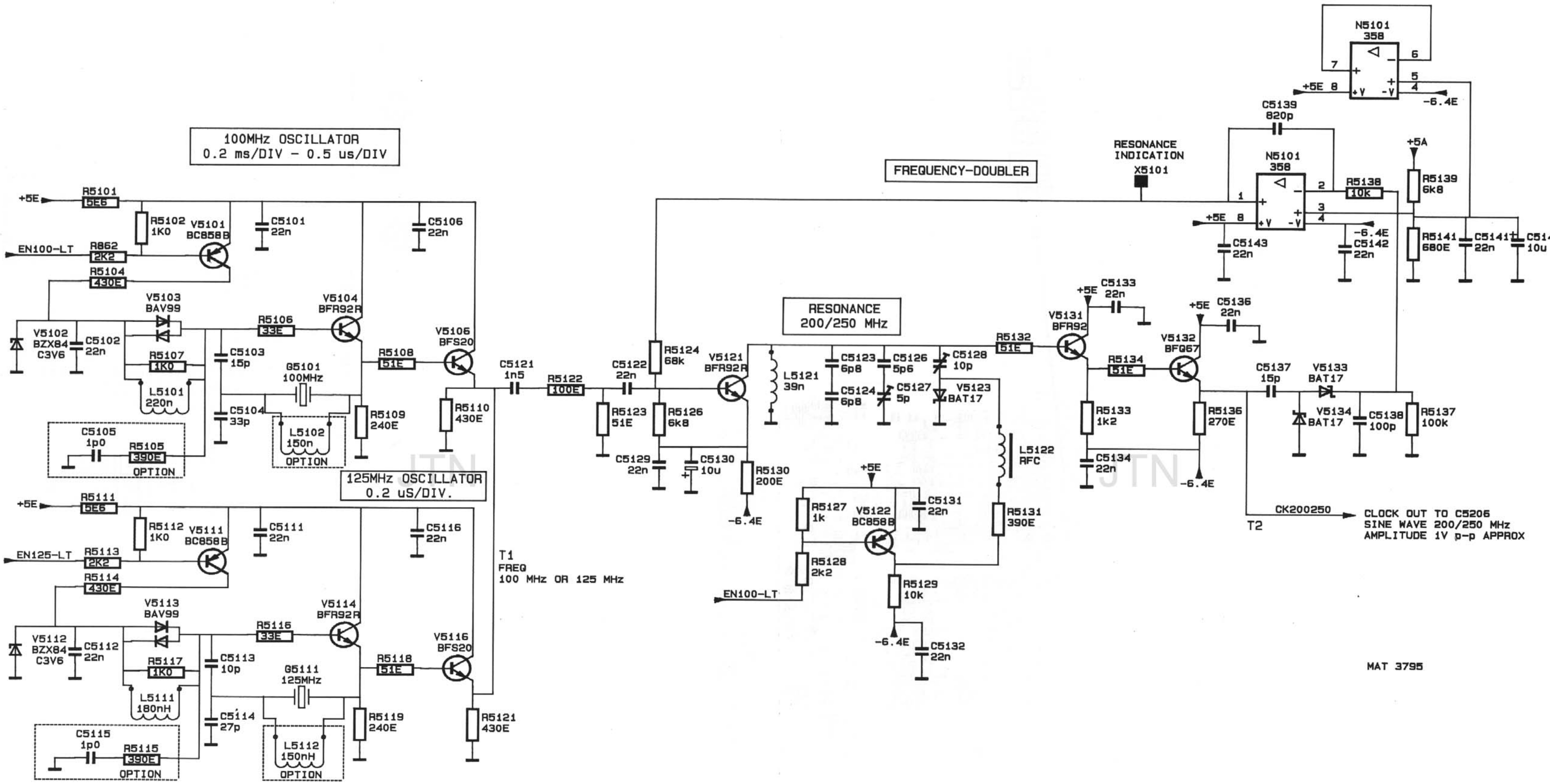


Figure 19-8 Circuit diagram of P²CCD, oscillator circuit

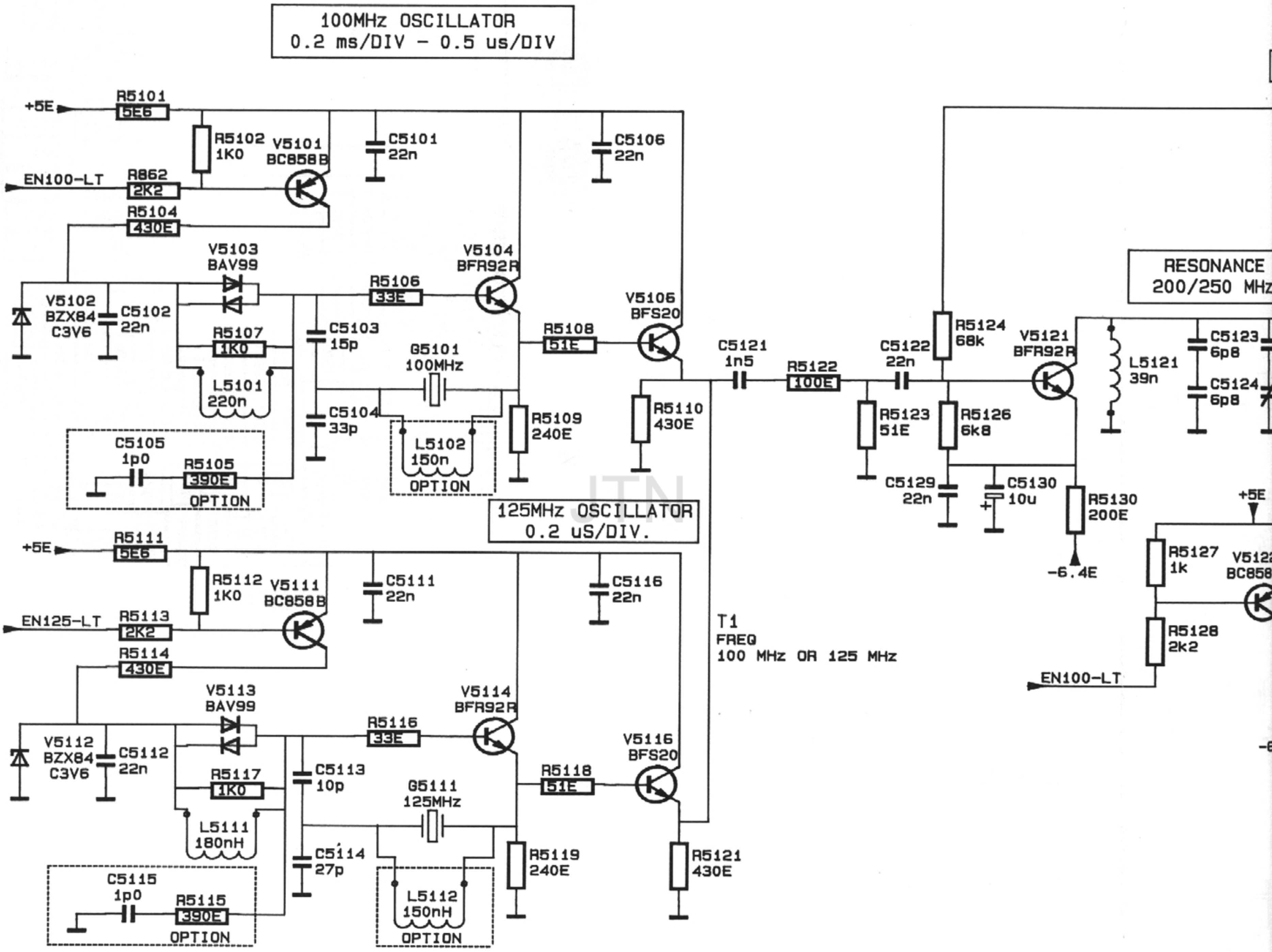
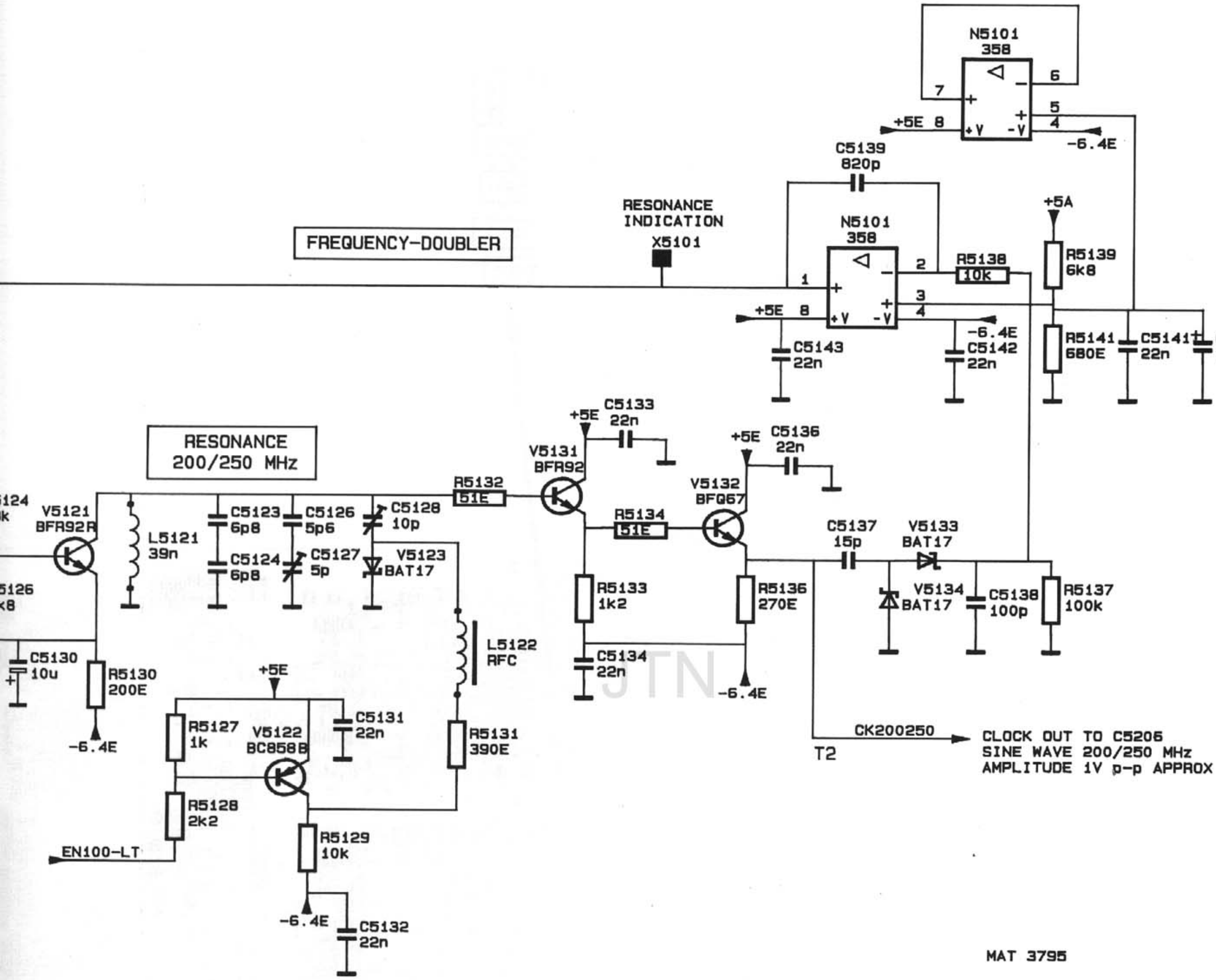
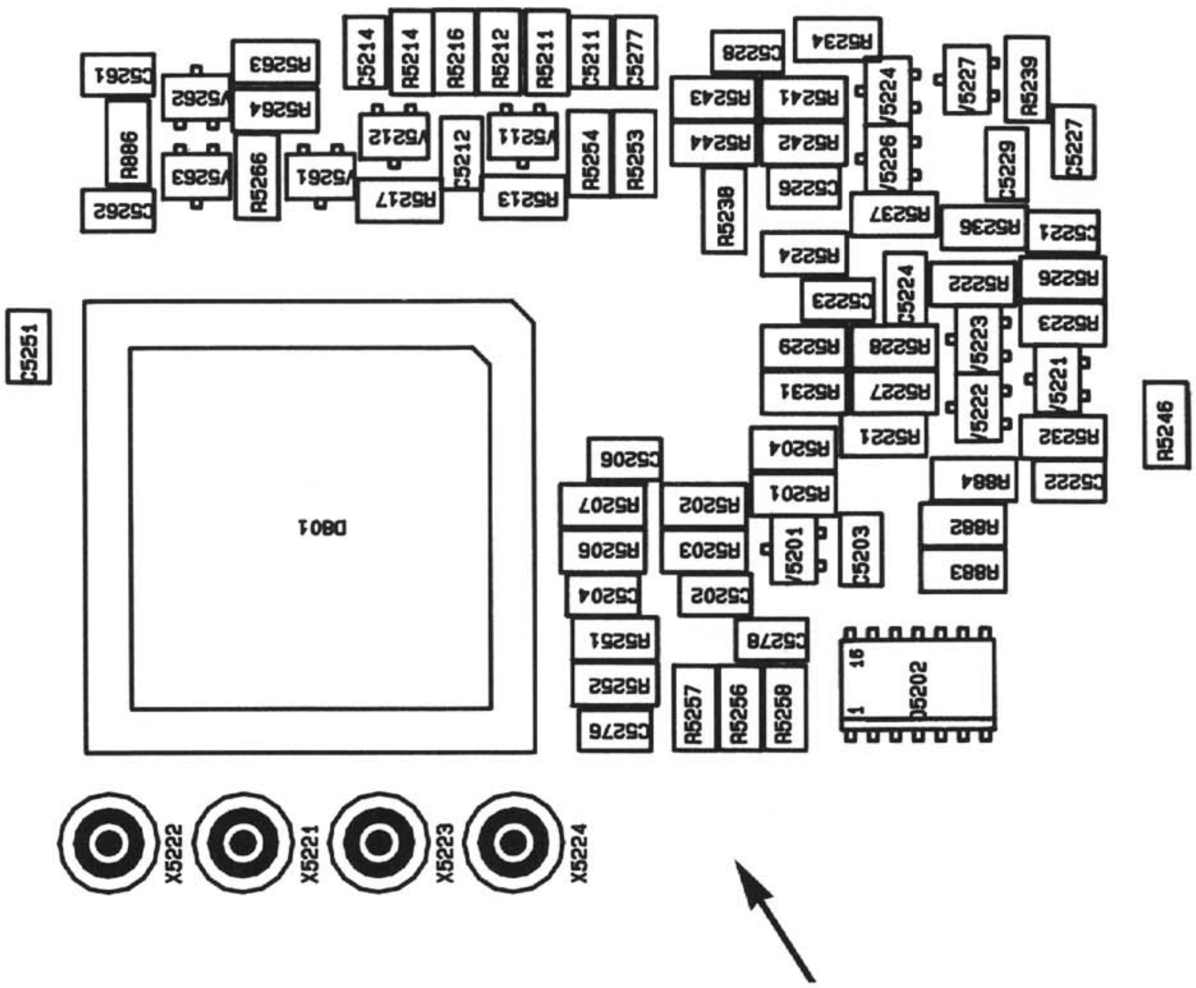
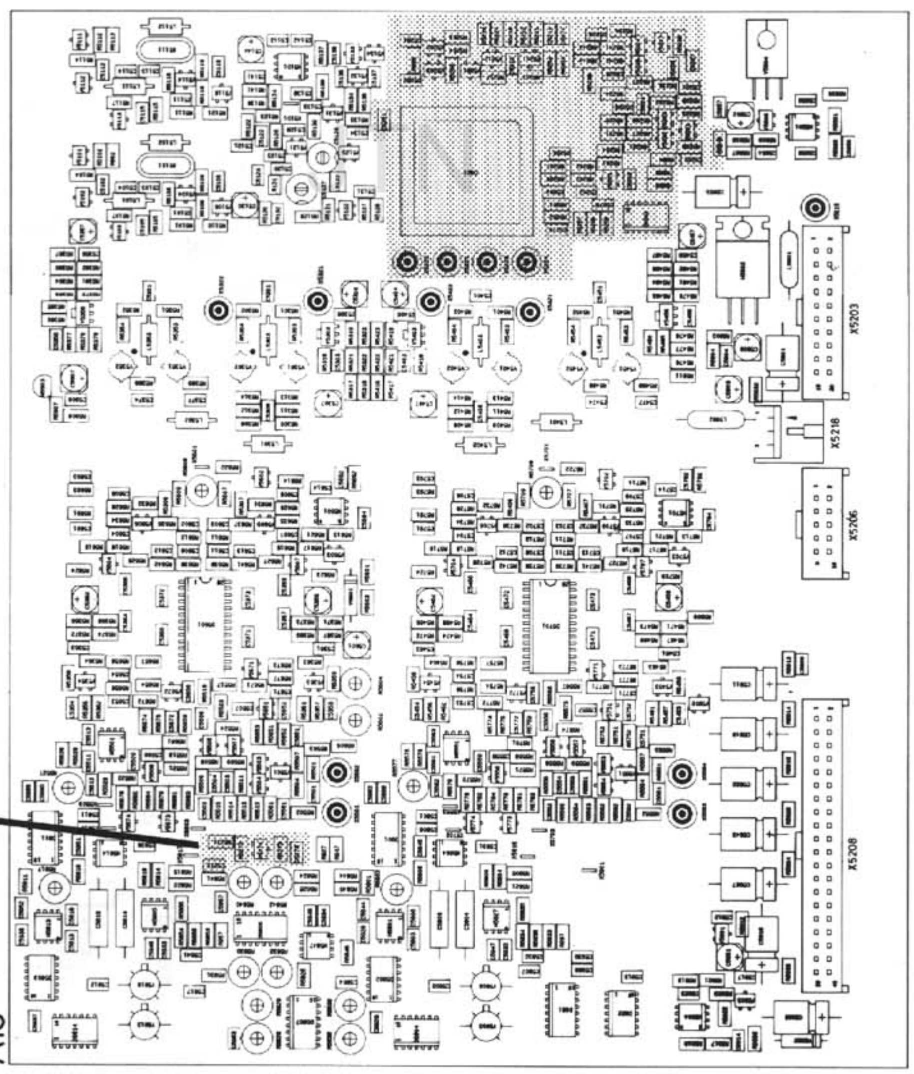


Figure 19-8 Circuit diagram of P²CCD, oscillator circuit


N5101
358
+5E 8
-6.4E
C5139
820p
RESONANCE
INDICATION
X5101
FREQUENCY-DOUBLER
N5101
358
R5138
10k
+5A
R5139
6k8
+5E 8
-6.4E
C5143
22n
C5142
22n
R5141
680E
C5141
22n
C5144
10u
+5E
C5133
22n
V5131
BFR92
+5E
C5136
22n
V5132
BFQ67
RESONANCE
200/250 MHz
V5121
BFR92R
L5121
39n
C5123
6p8
C5124
6p8
C5126
5p6
C5127
5p
C5128
10p
V5123
BAT17
R5132
51E
R5134
51E
C5137
15p
V5133
BAT17
V5134
BAT17
C5138
100p
R5137
100k
R5133
1k2
R5136
270E
C5134
22n
-6.4E
L5122
RFC
C5130
10u
R5130
200E
-6.4E
+5E
R5127
1k
V5122
BC858B
C5131
22n
R5131
390E
R5128
2k2
EN100-LT
R5129
10k
-6.4E
C5132
22n
CK200250
T2
CLOCK OUT TO C5206
SINE WAVE 200/250 MHz
AMPLITUDE 1V p-p APPROX
MAT 3795



Component Values are not
meant to be clear on this view.
See exploded views in this section



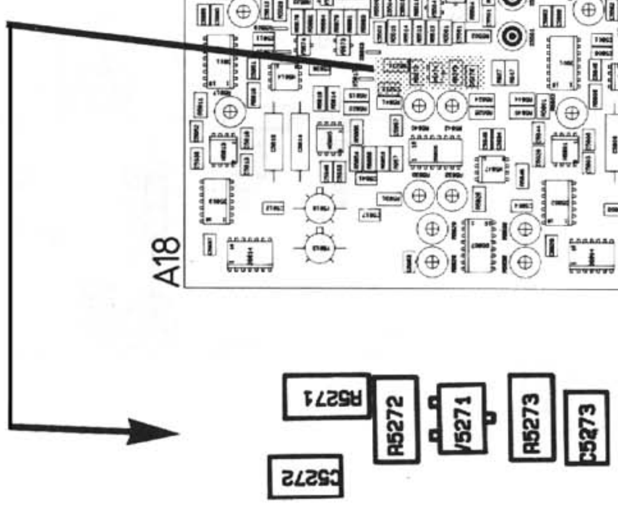


Figure 19-9 Part of P^2CCD unit p.c.b., part 2

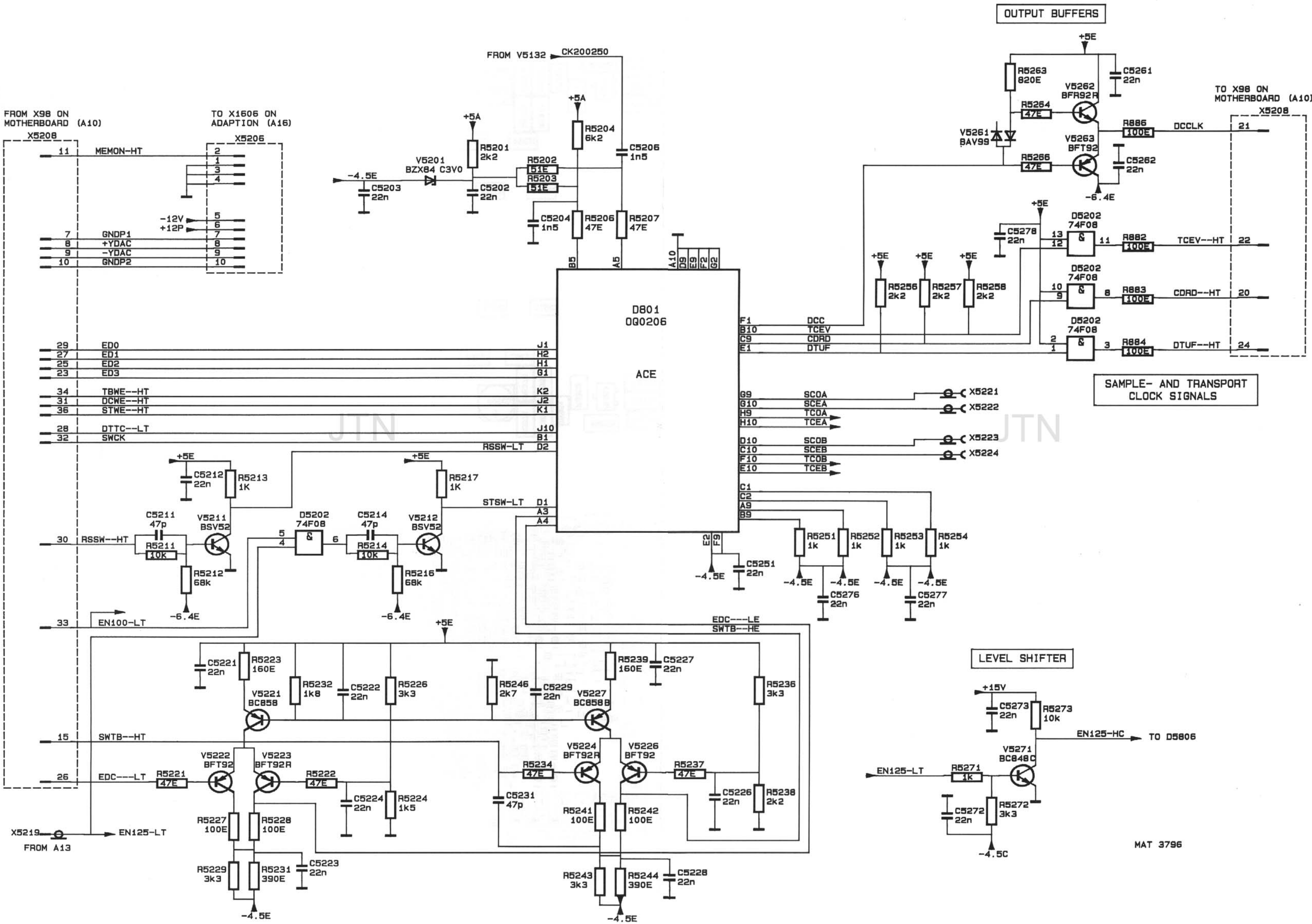


Figure 19.10 Circuit diagram of P^2CCD, ACE

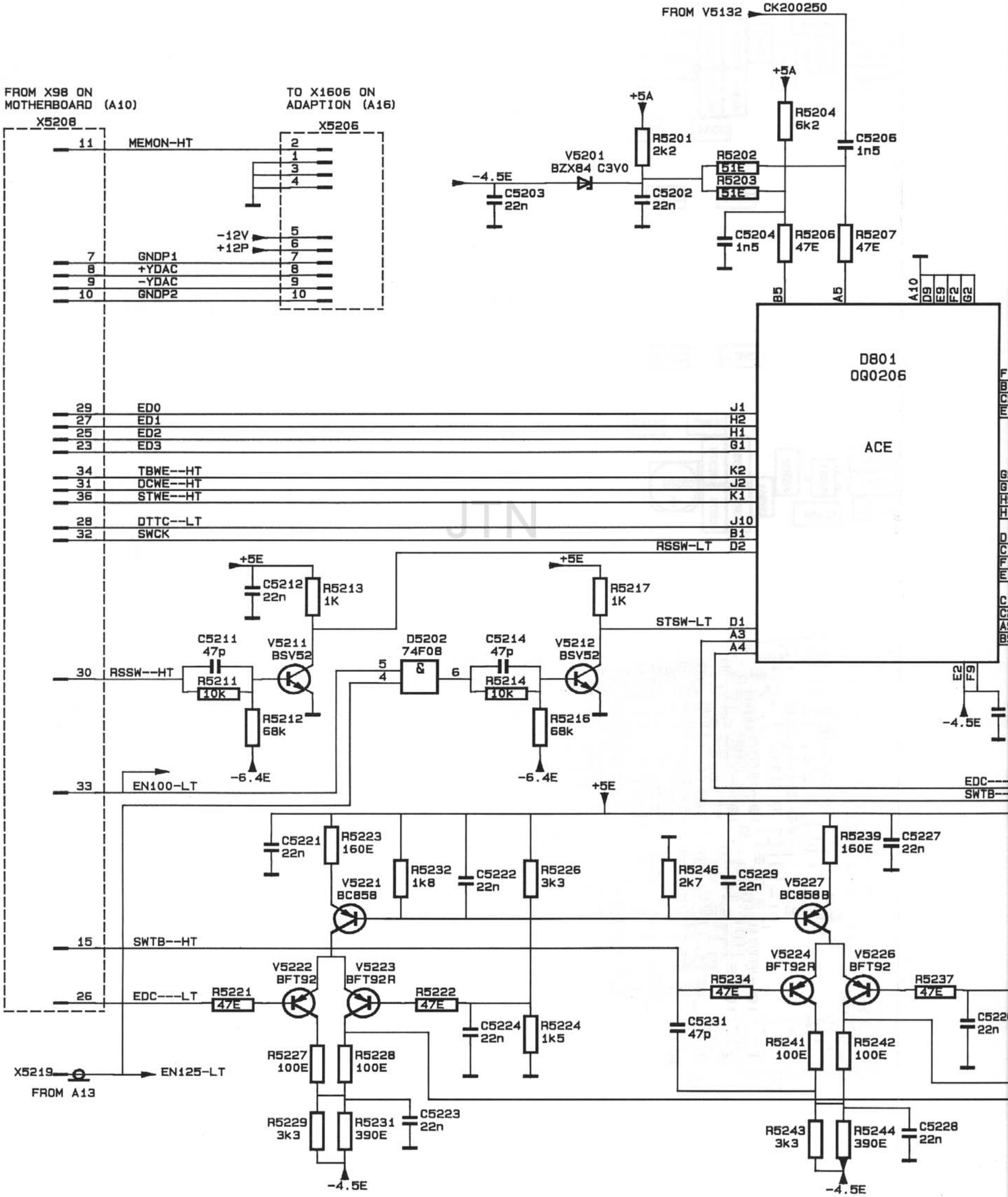
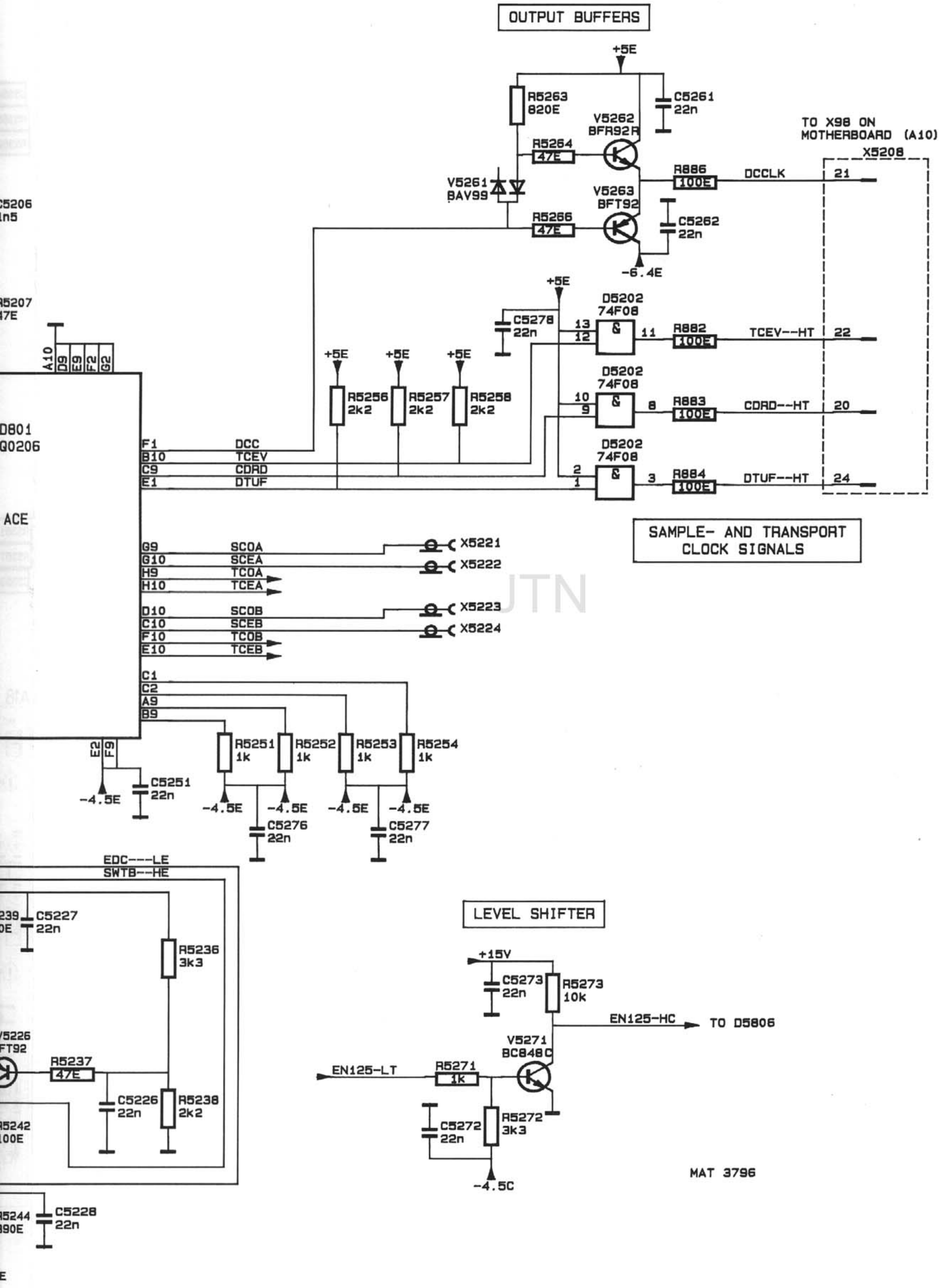
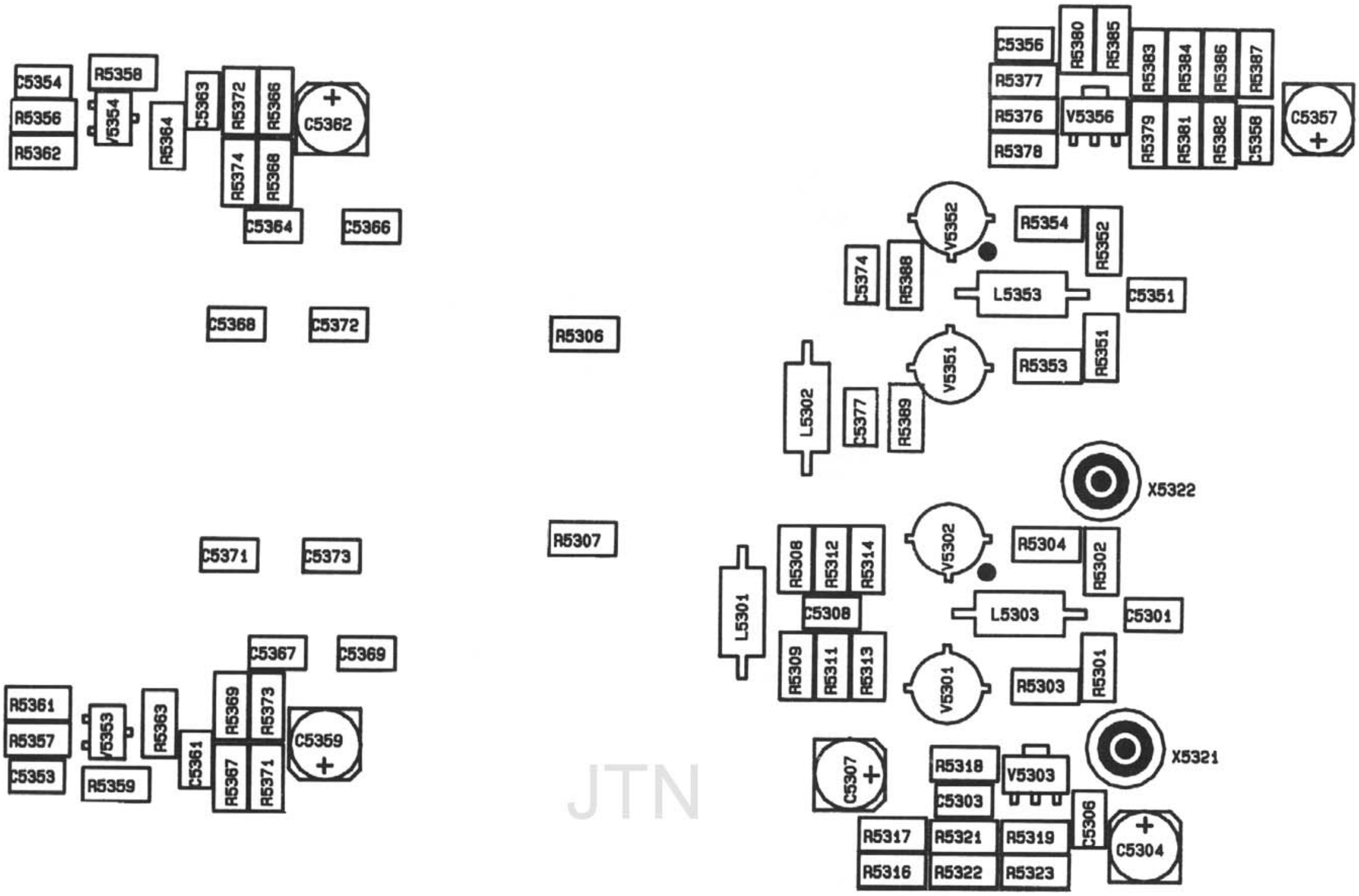


Figure 19.10 Circuit diagram of P^2CCD, ACE



OUTPUT BUFFERS
+5E
R5263
820E
C5261
22n
V5262
BFR92R
TO X98 ON
MOTHERBOARD (A10)
X5208
R5264
47E
R886
100E
DCCLK
V5261
BAV99
V5263
BFT92
R5266
47E
C5262
22n
-6.4E
D5202
74F08
C5278
22n
R882
100E
TCEV--HT
R5256
2k2
R5257
2k2
R5258
2k2
R883
100E
CDRD--HT
R884
100E
DTUF--HT
C5206
1n5
R5207
47E
D801
Q0206
ACE
DCC
TCEV
CDRD
DTUF
SAMPLE- AND TRANSPORT
CLOCK SIGNALS
SCOA
SCEA
TCOA
TCEA
X5221
X5222
SCOB
SCEB
TCOB
TCEB
X5223
X5224
R5251
1k
R5252
1k
R5253
1k
R5254
1k
-4.5E
C5251
22n
C5276
22n
C5277
22n
EDC---LE
SWTB--HE
C5227
22n
R5236
3k3
LEVEL SHIFTER
+15V
C5273
22n
R5273
10k
EN125-HC
TO D5806
V5226
FT92
R5237
47E
V5271
BC848C
EN125-LT
R5271
1k
C5226
22n
R5238
2k2
R5242
100E
C5272
22n
R5272
3k3
-4.5C
MAT 3796
R5244
390E
C5228
22n



A18

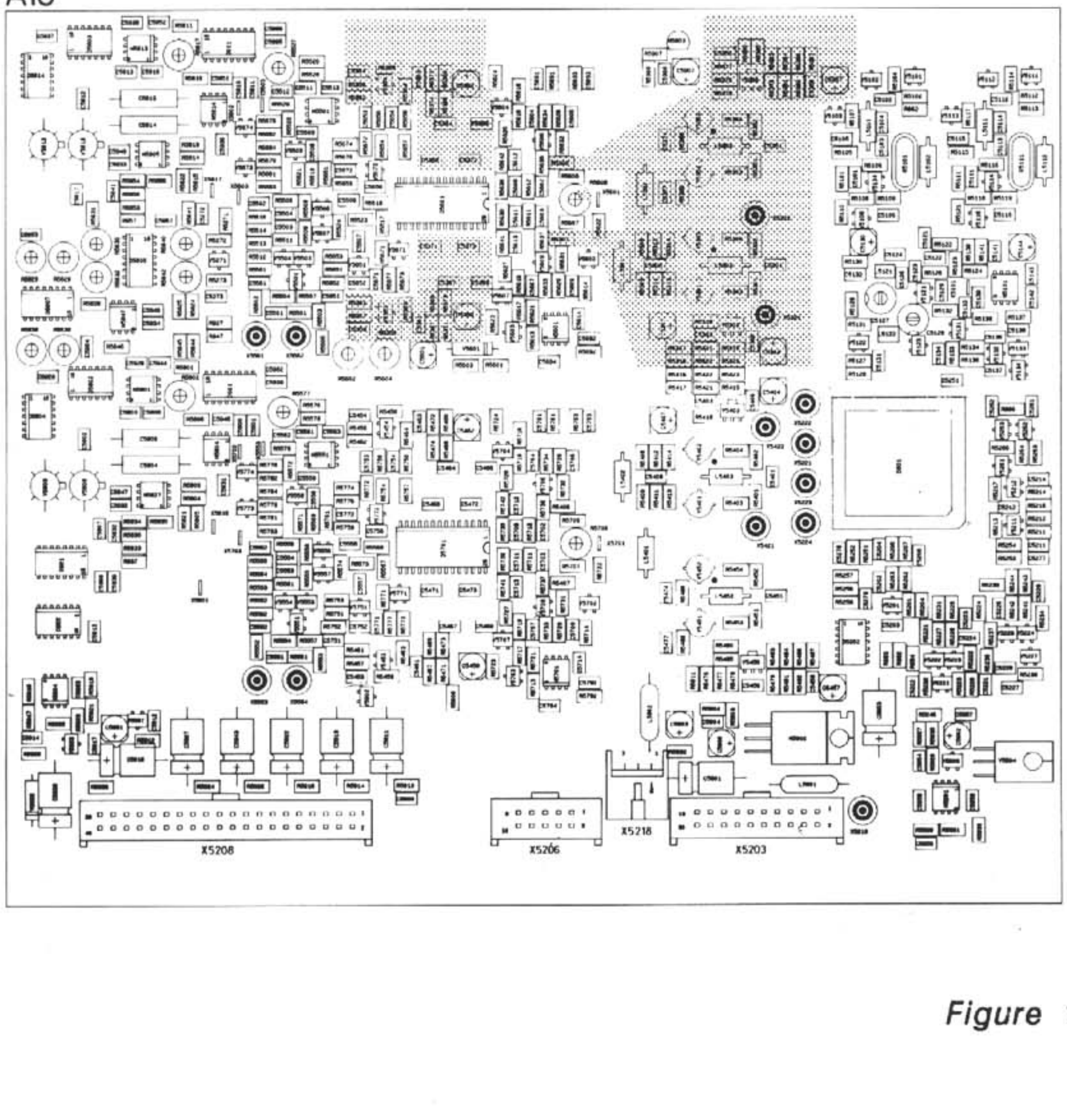


Figure 19.11 Part of P^2CCD unit p.c.b., part 3

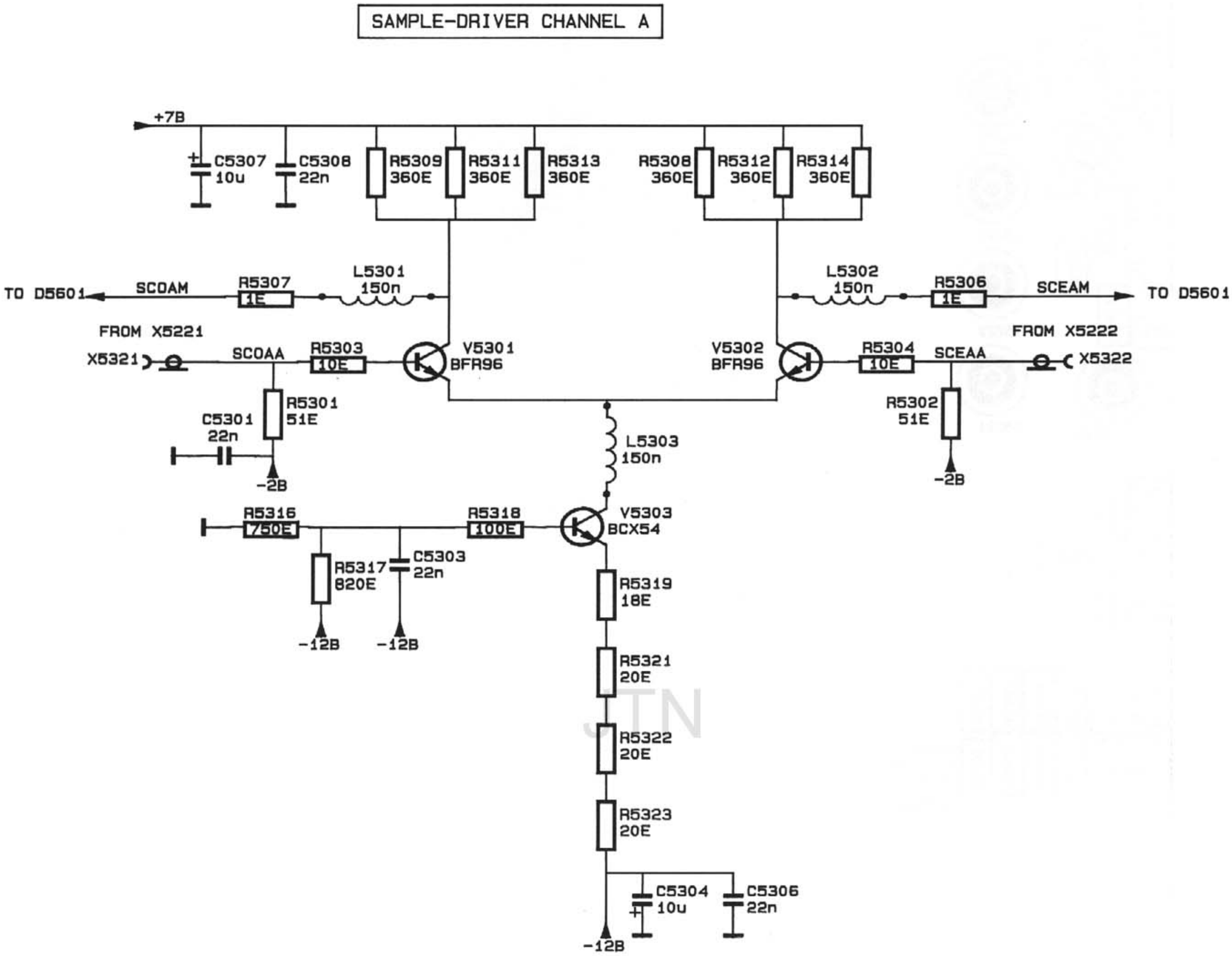
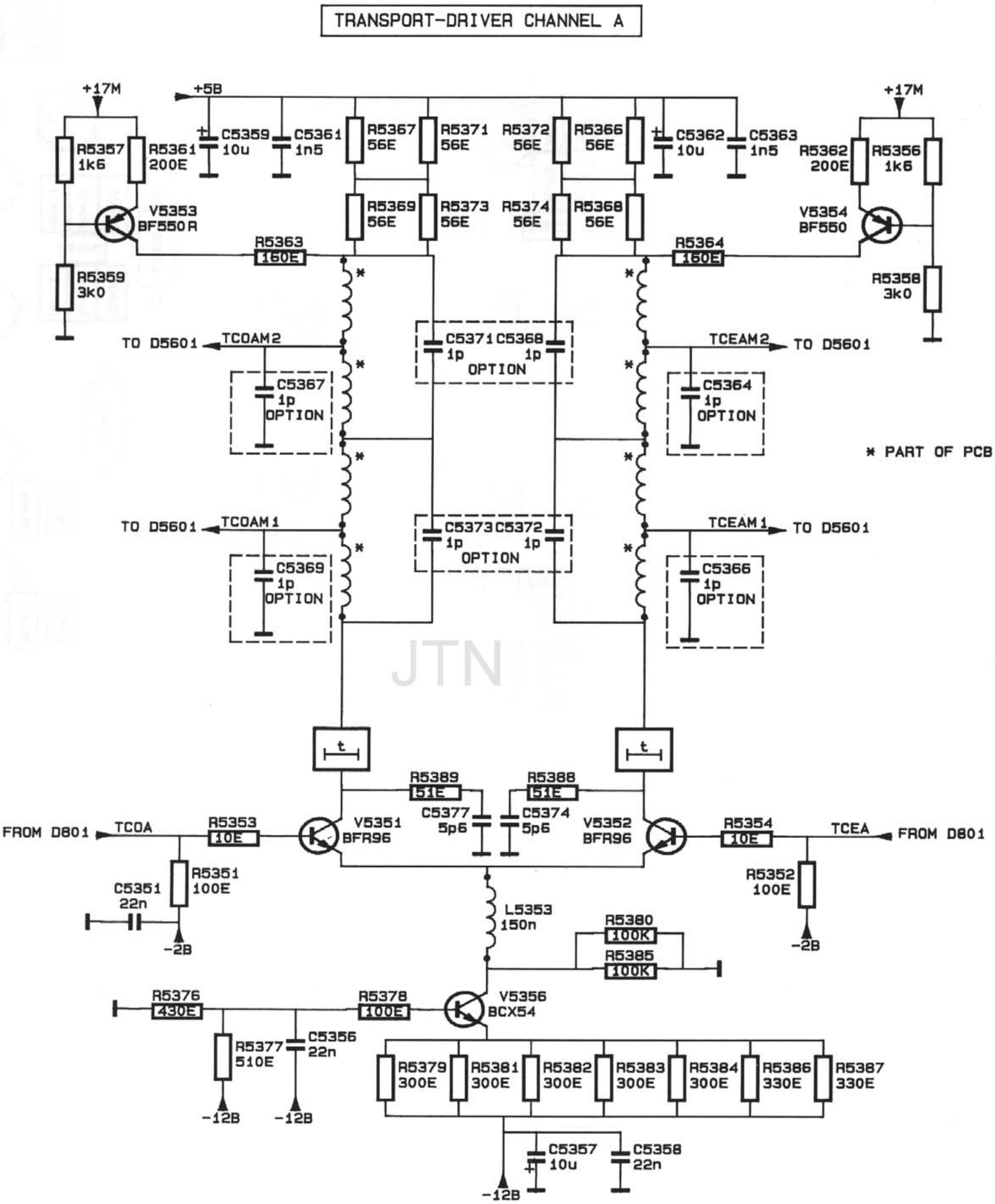
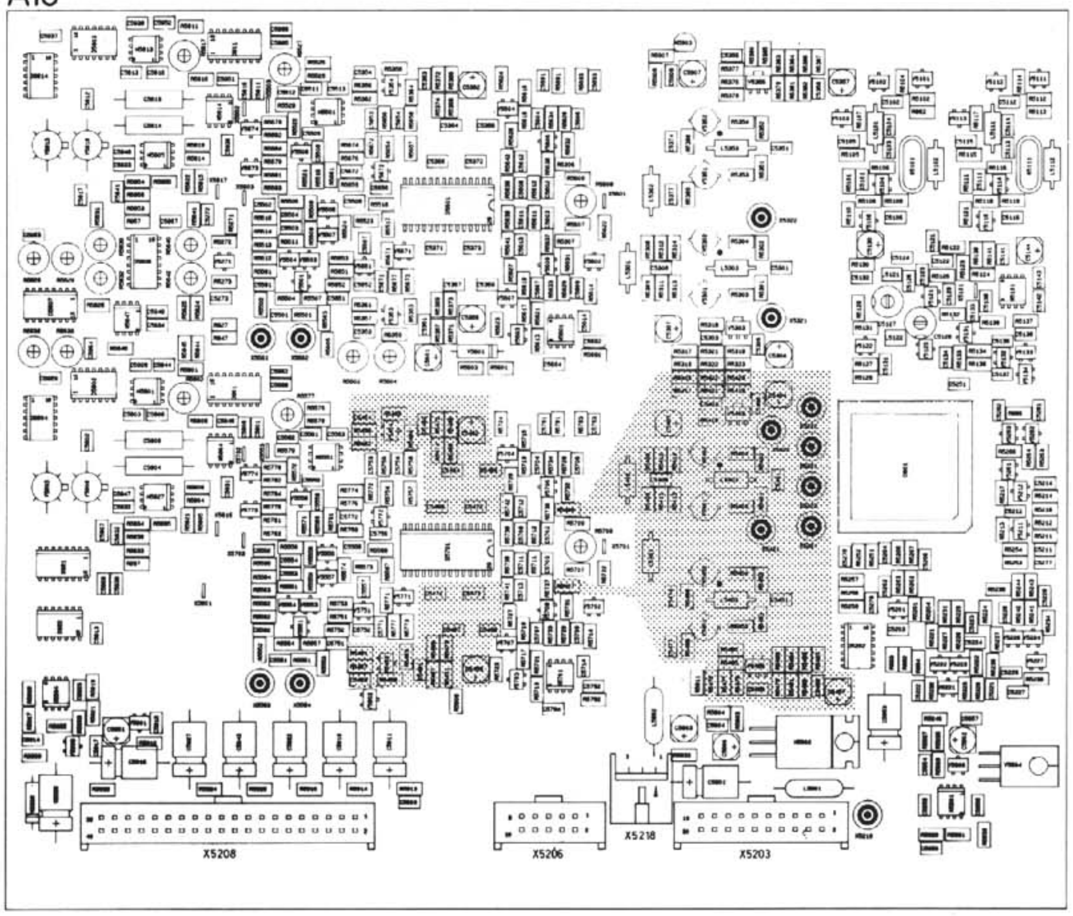


Figure 19-12 Circuit diagram of P^2CCD, clock drivers channel A


TRANSPORT-DRIVER CHANNEL A
+17M
+5B
R5357 1k6
R5361 200E
C5359 10u
C5361 1n5
R5367 56E
R5371 56E
R5372 56E
R5366 56E
C5362 10u
C5363 1n5
R5362 200E
R5356 1k6
V5353 BF550R
R5369 56E
R5373 56E
R5374 56E
R5368 56E
V5354 BF550
R5363 160E
R5364 160E
R5359 3k0
R5358 3k0
TO D5601
TCOAM2
C5371 1p
C5368 1p
OPTION
TCEAM2
C5367 1p OPTION
C5364 1p OPTION
* PART OF PCB
TCOAM1
C5373 1p
C5372 1p
TCEAM1
C5369 1p OPTION
C5366 1p OPTION
R5389 51E
R5388 51E
C5377 5p6
C5374 5p6
FROM D801
TCOA
R5353 10E
V5351 BFR96
V5352 BFR96
R5354 10E
TCEA
R5351 100E
C5351 22n
R5352 100E
-2B
L5353 150n
R5380 100K
R5385 100K
R5376 430E
R5378 100E
V5356 BCX54
R5377 510E
C5356 22n
-12B
R5379 300E
R5381 300E
R5382 300E
R5383 300E
R5384 300E
R5386 330E
R5387 330E
C5357 10u
C5358 22n

MAT 3797

A18



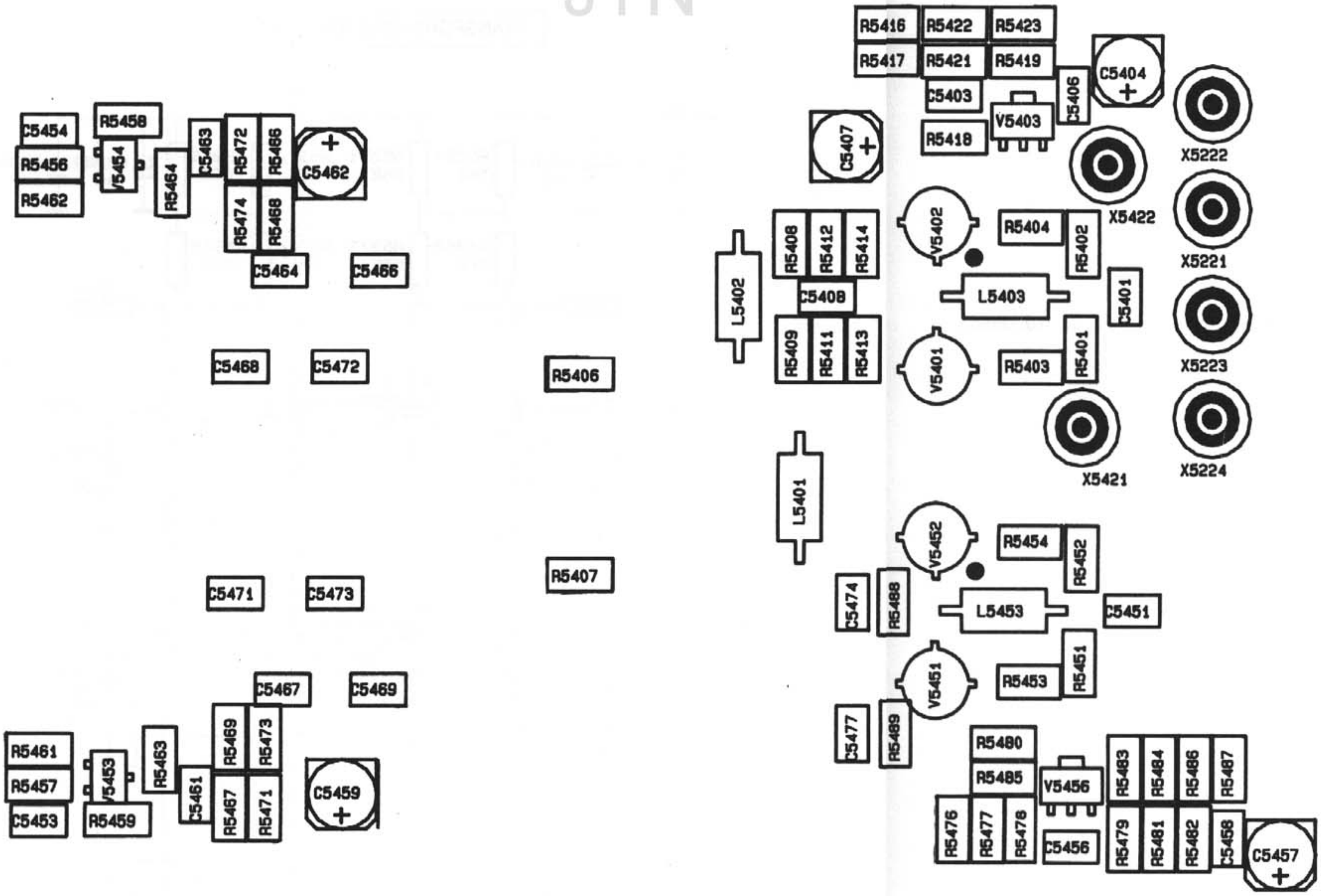


Figure 19.13 Part of P^2CCD unit p.c.b., part 4

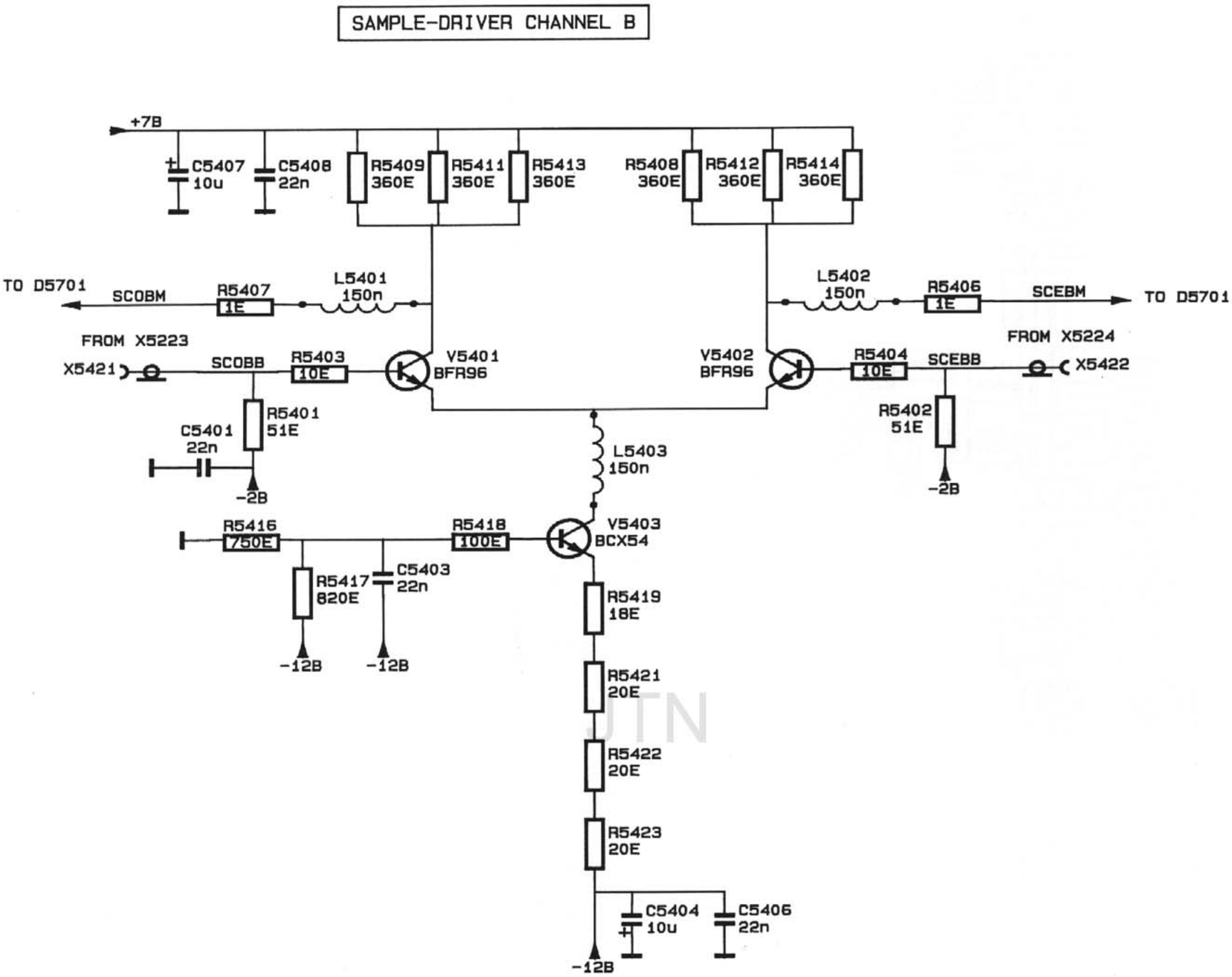
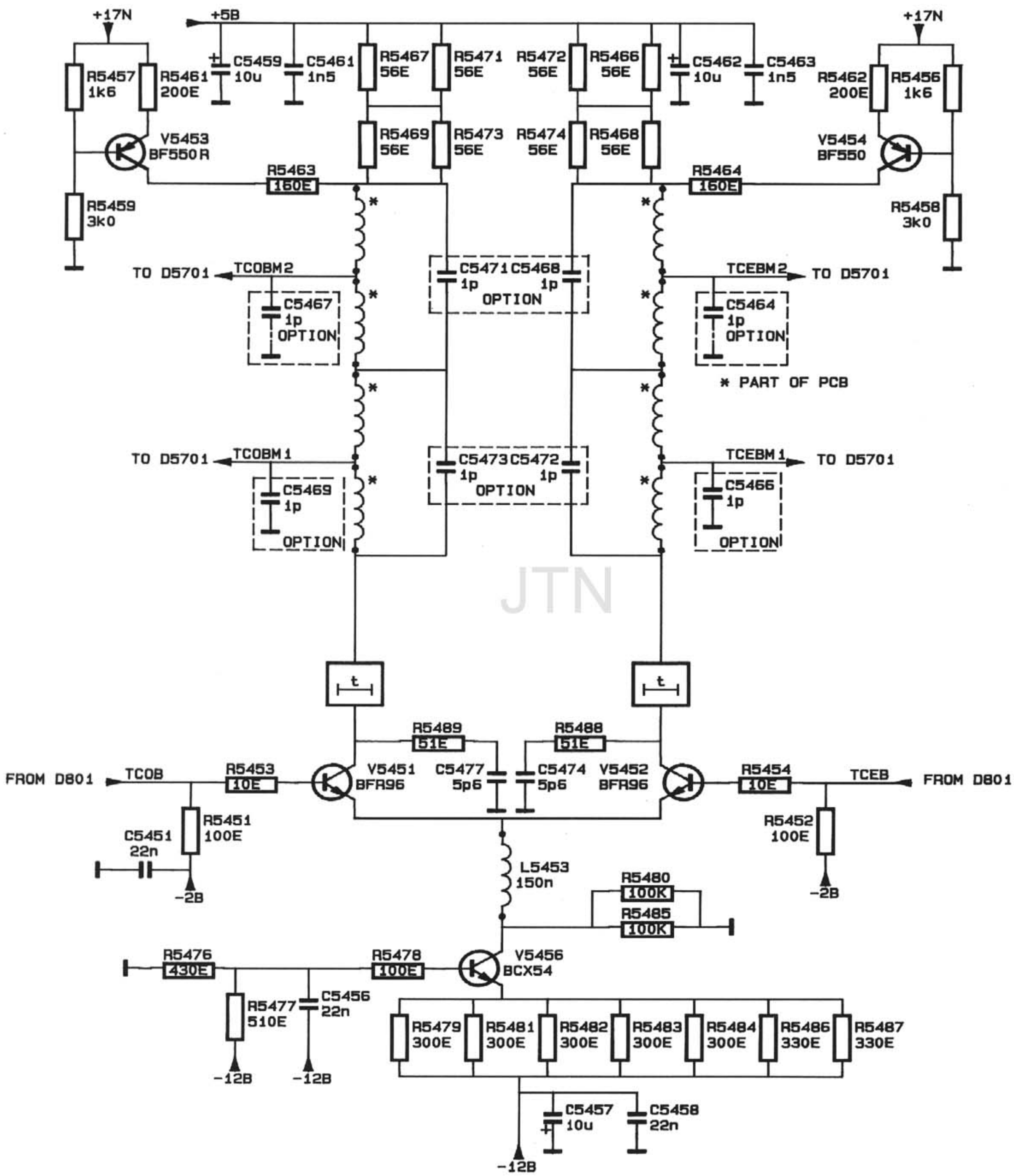
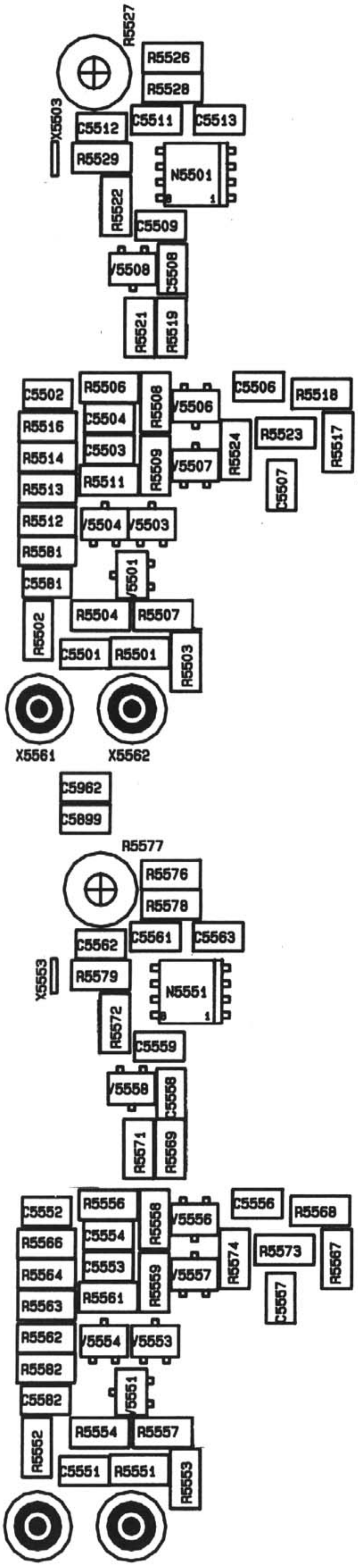


Figure 19.14 Circuit diagram of P^2CCD, clock drivers channel B

TRANSPORT-DRIVER CHANNEL B



MAT 3798



A18

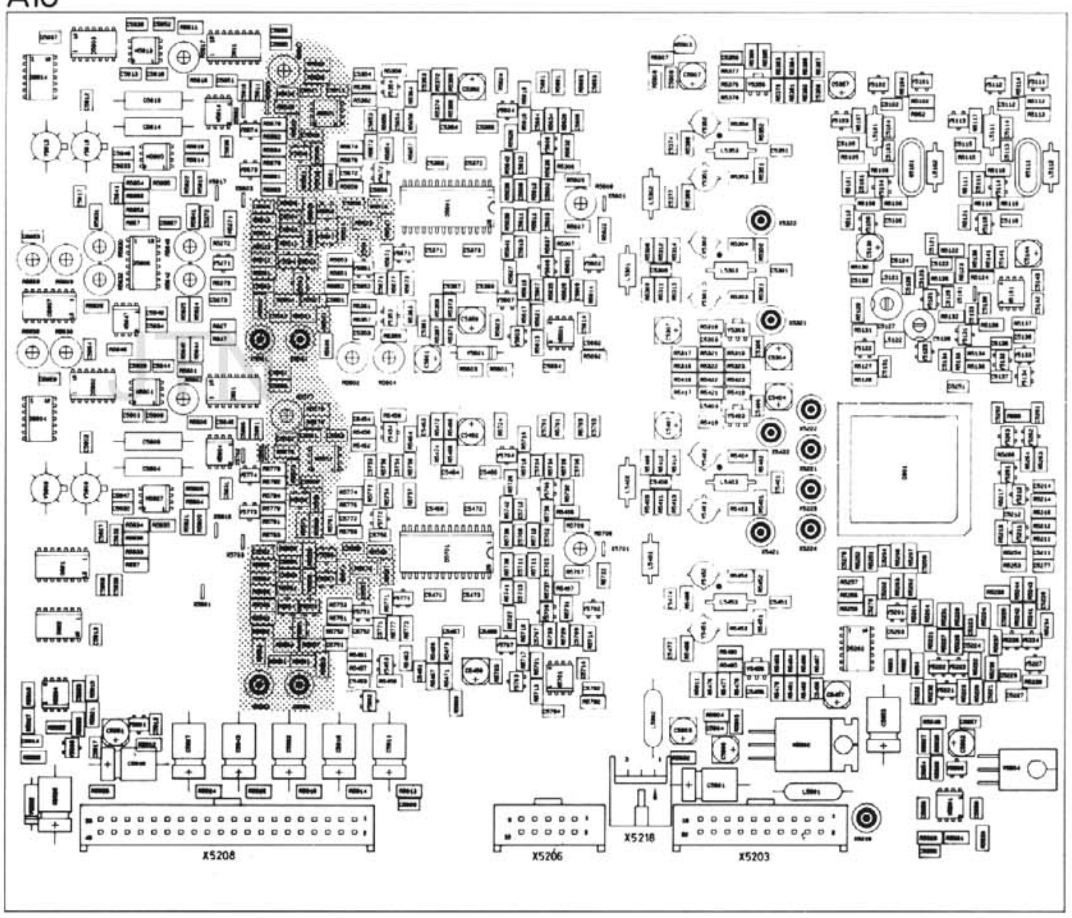


Figure 19.15 Part of P^2CCD unit p.c.b., part 5

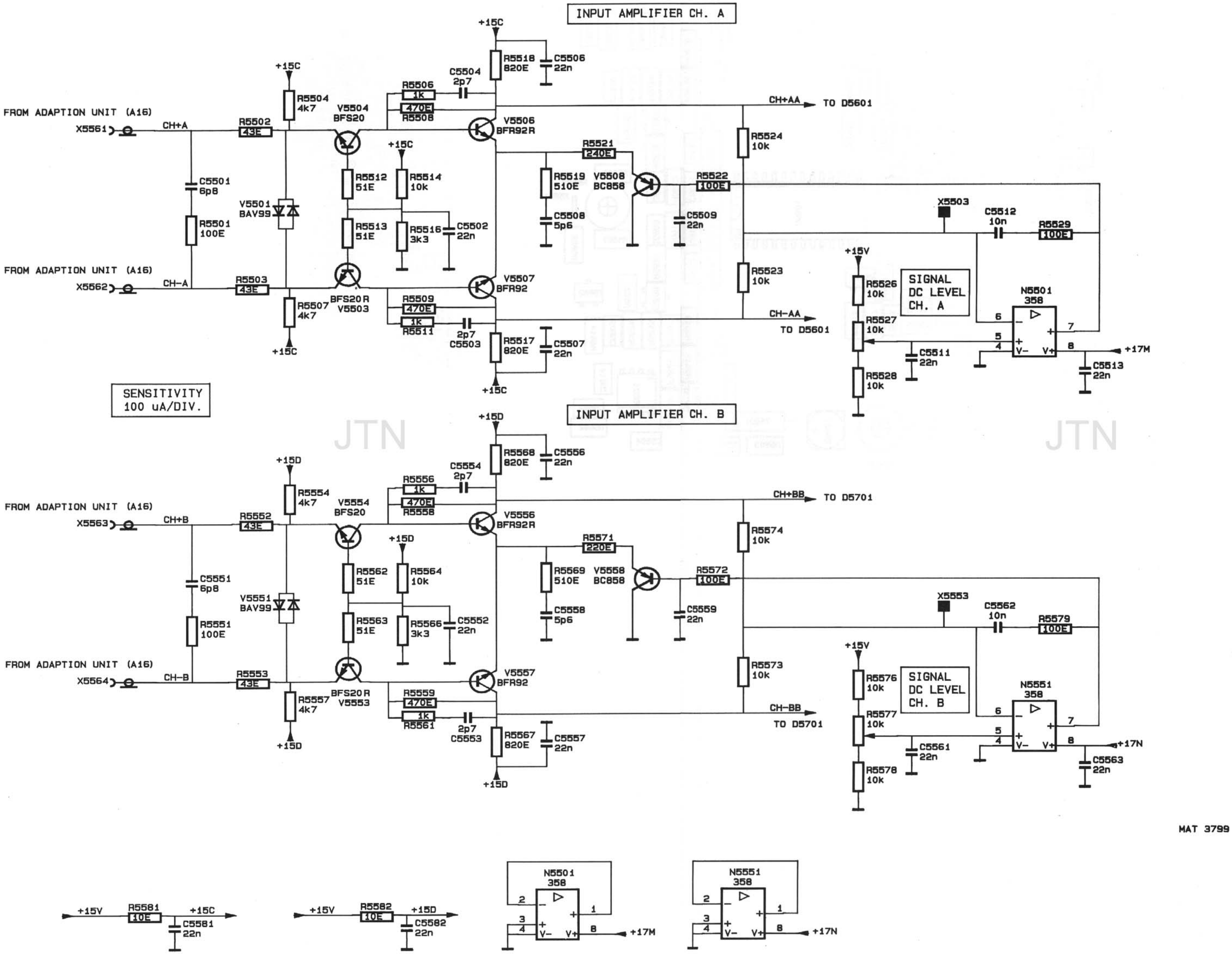


Figure 19.16 Circuit diagram of P^2CCD, input amplifiers

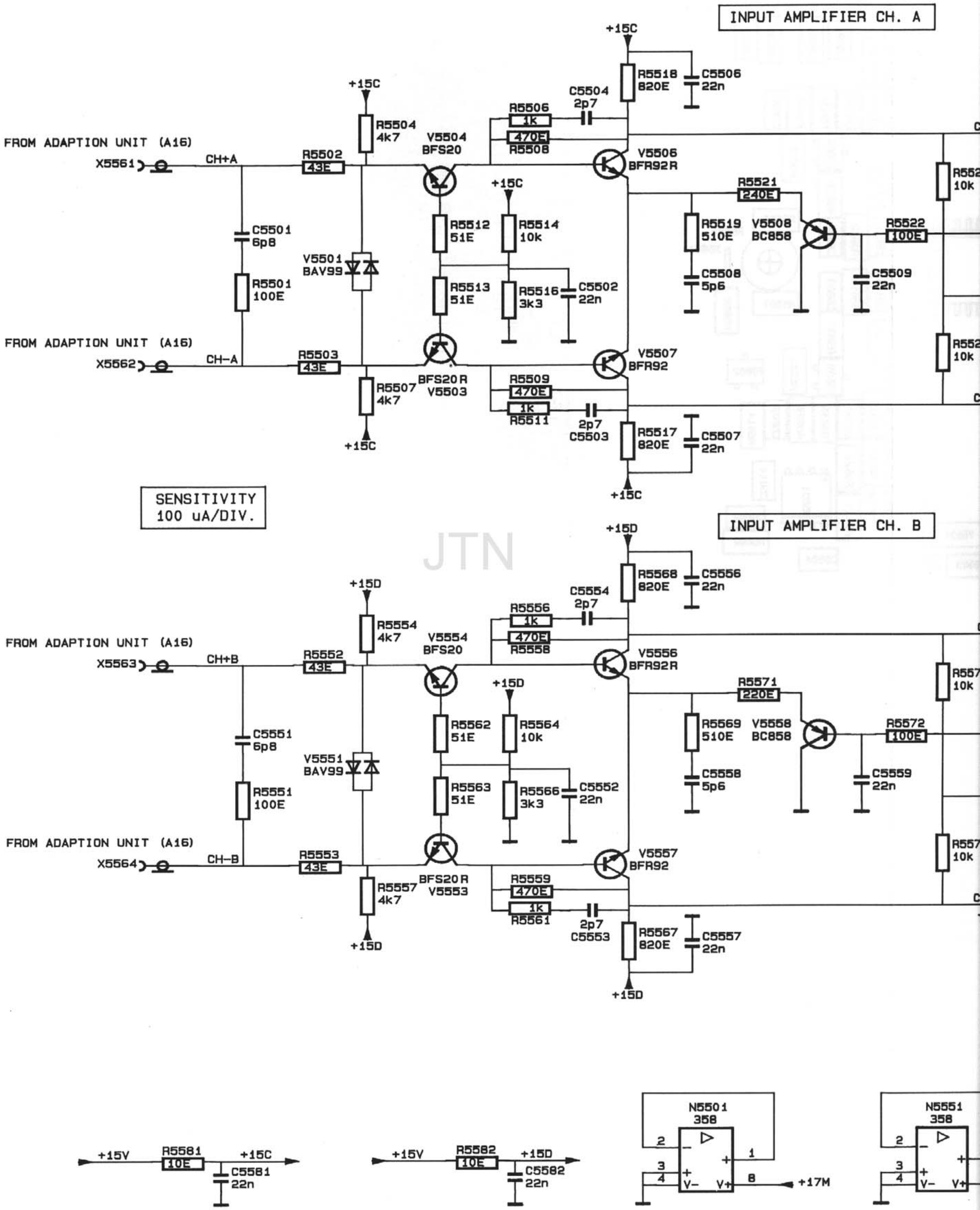
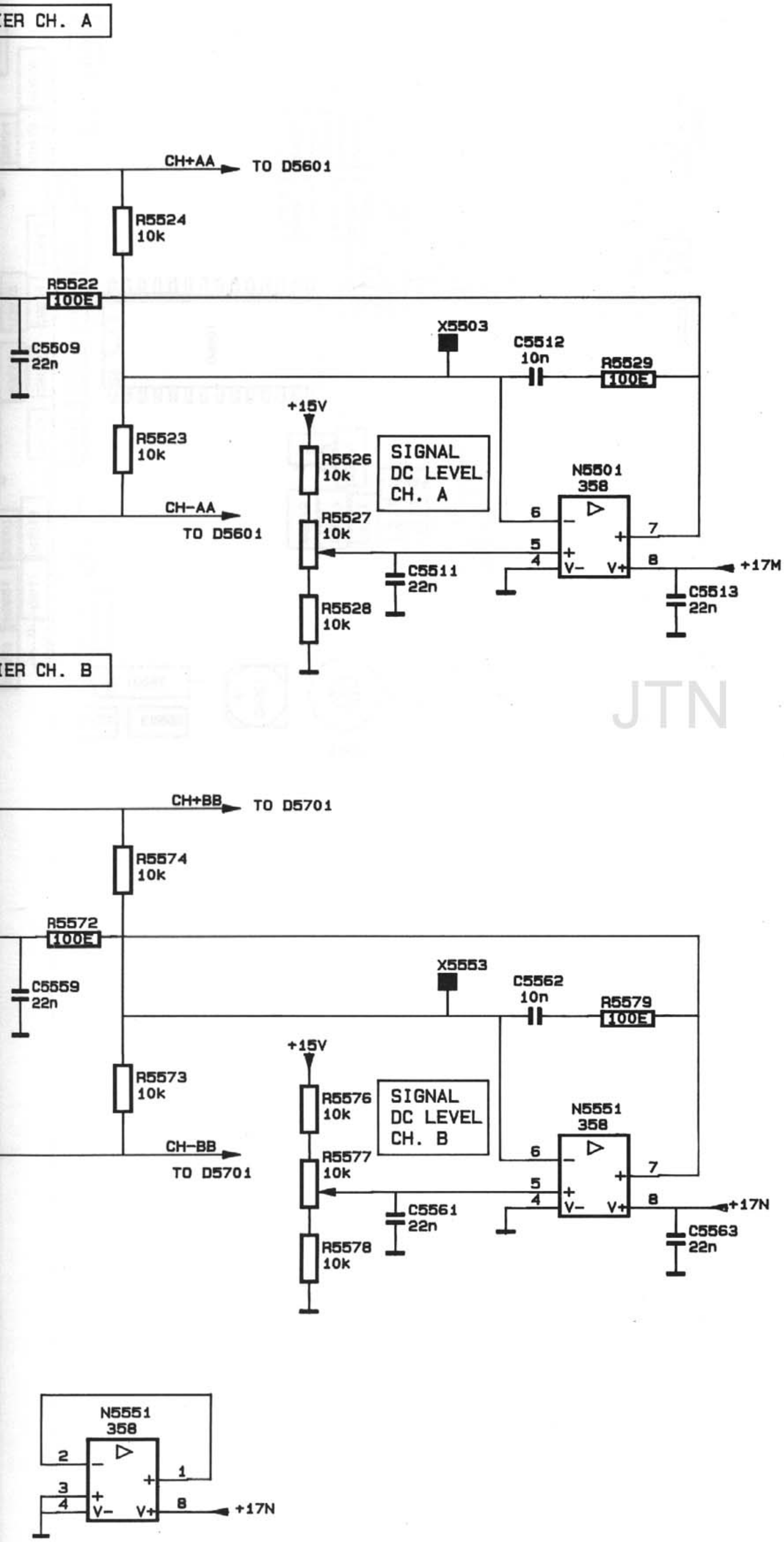


Figure 19.16 Circuit diagram of P^2CCD, input amplifiers



IER CH. A
CH+AA
TO D5601
R5524
10k
R5522
100E
C5509
22n
X5503
C5512
10n
R5529
100E
+15V
R5523
10k
R5526
10k
SIGNAL
DC LEVEL
CH. A
N5501
358
CH-AA
TO D5601
R5527
10k
C5511
22n
+17M
C5513
22n
R5528
10k
IER CH. B
CH+BB
TO D5701
R5574
10k
R5572
100E
C5559
22n
X5553
C5562
10n
R5579
100E
+15V
R5573
10k
R5576
10k
SIGNAL
DC LEVEL
CH. B
N5551
358
CH-BB
TO D5701
R5577
10k
C5561
22n
+17N
C5563
22n
R5578
10k
N5551
358
+17N

MAT 3799

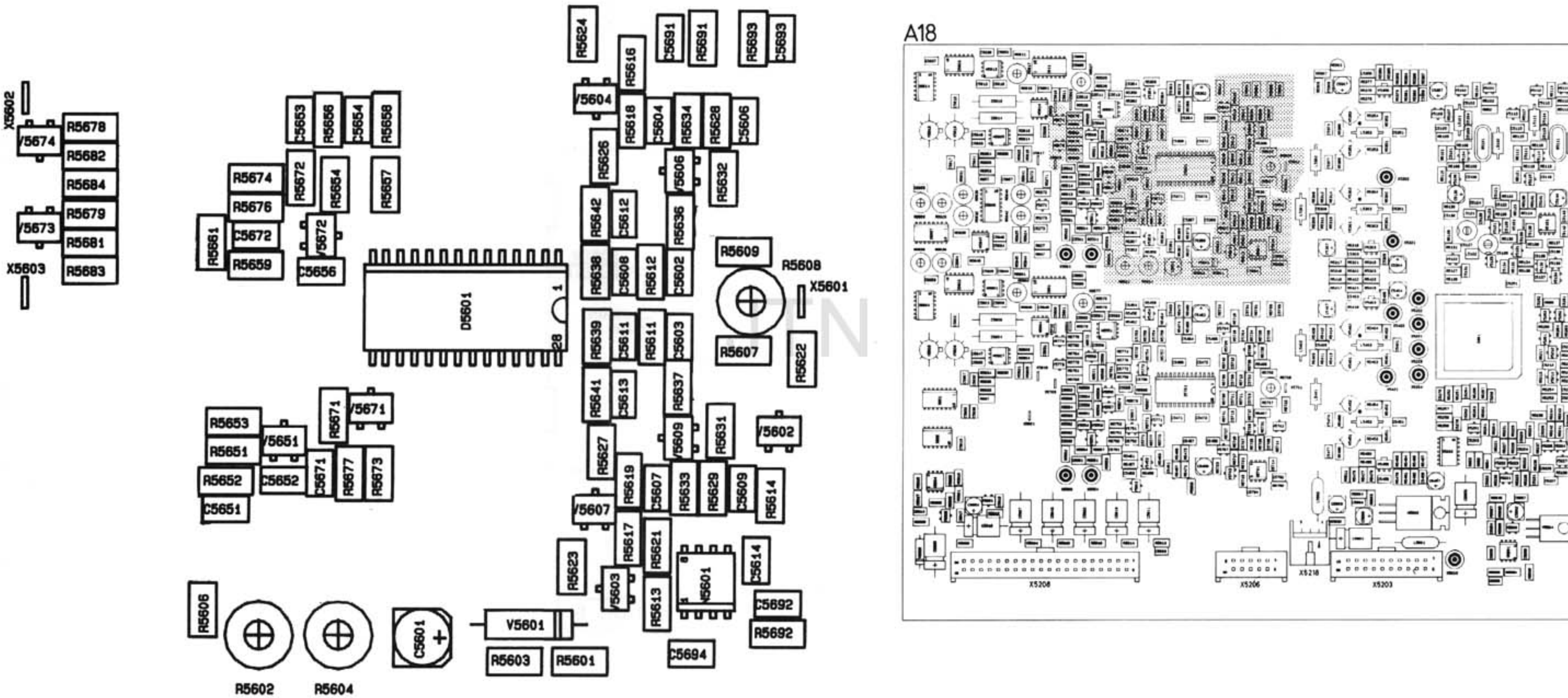


Figure 19.17 Part of P^{2}CCD unit p.c.b., part 6

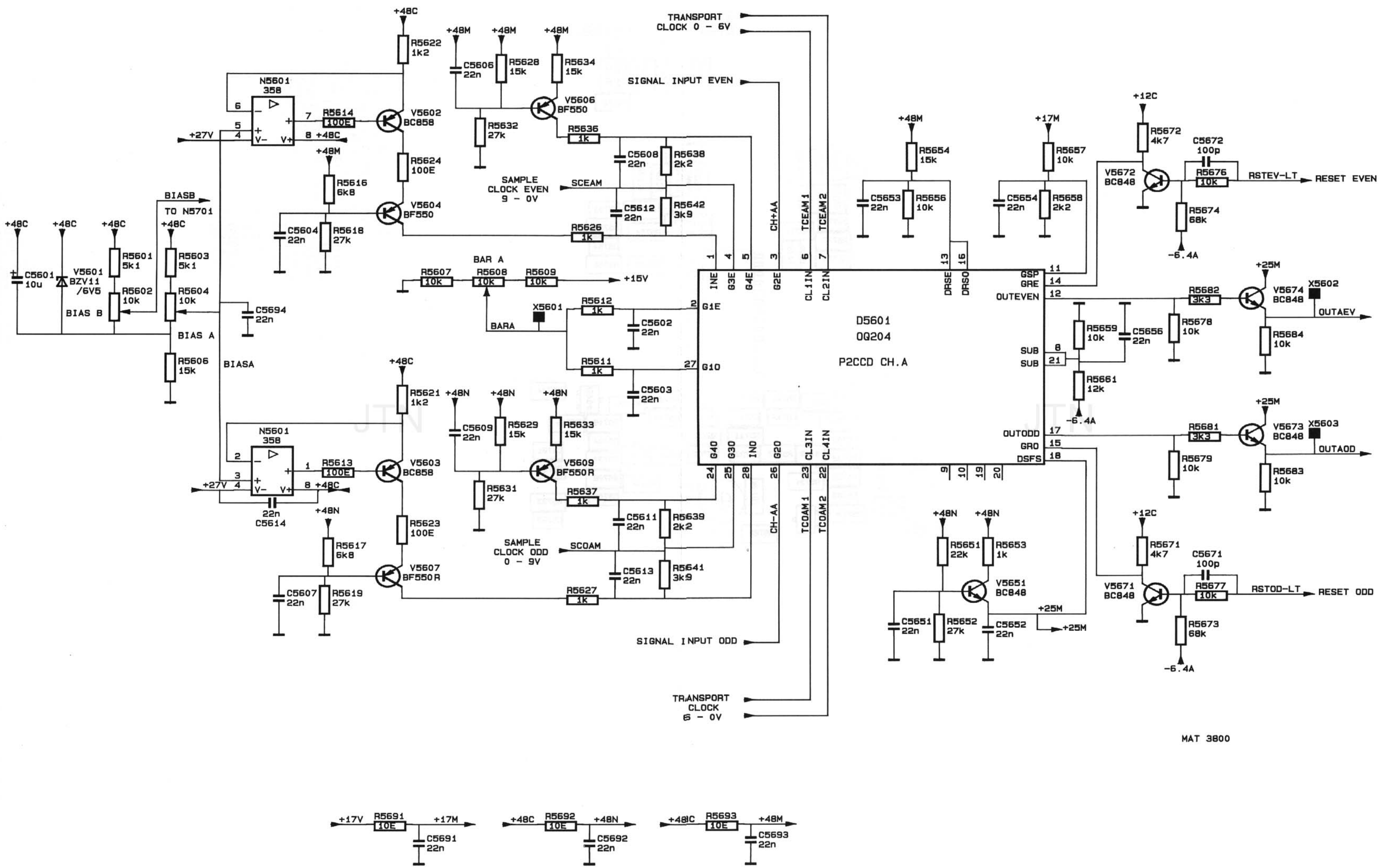


Figure 19.18 Circuit diagram of P²CCD, P²CCD channel A

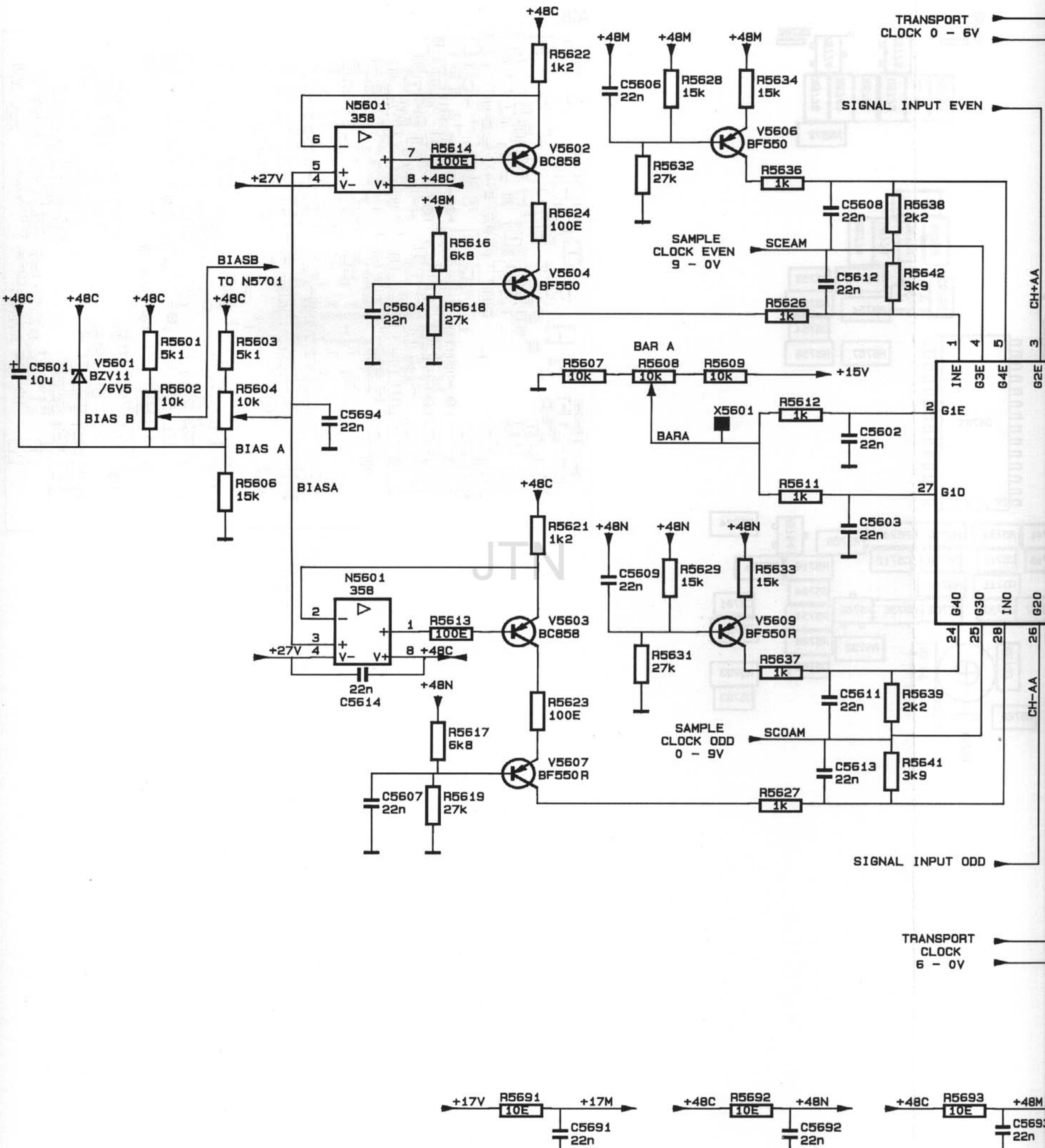
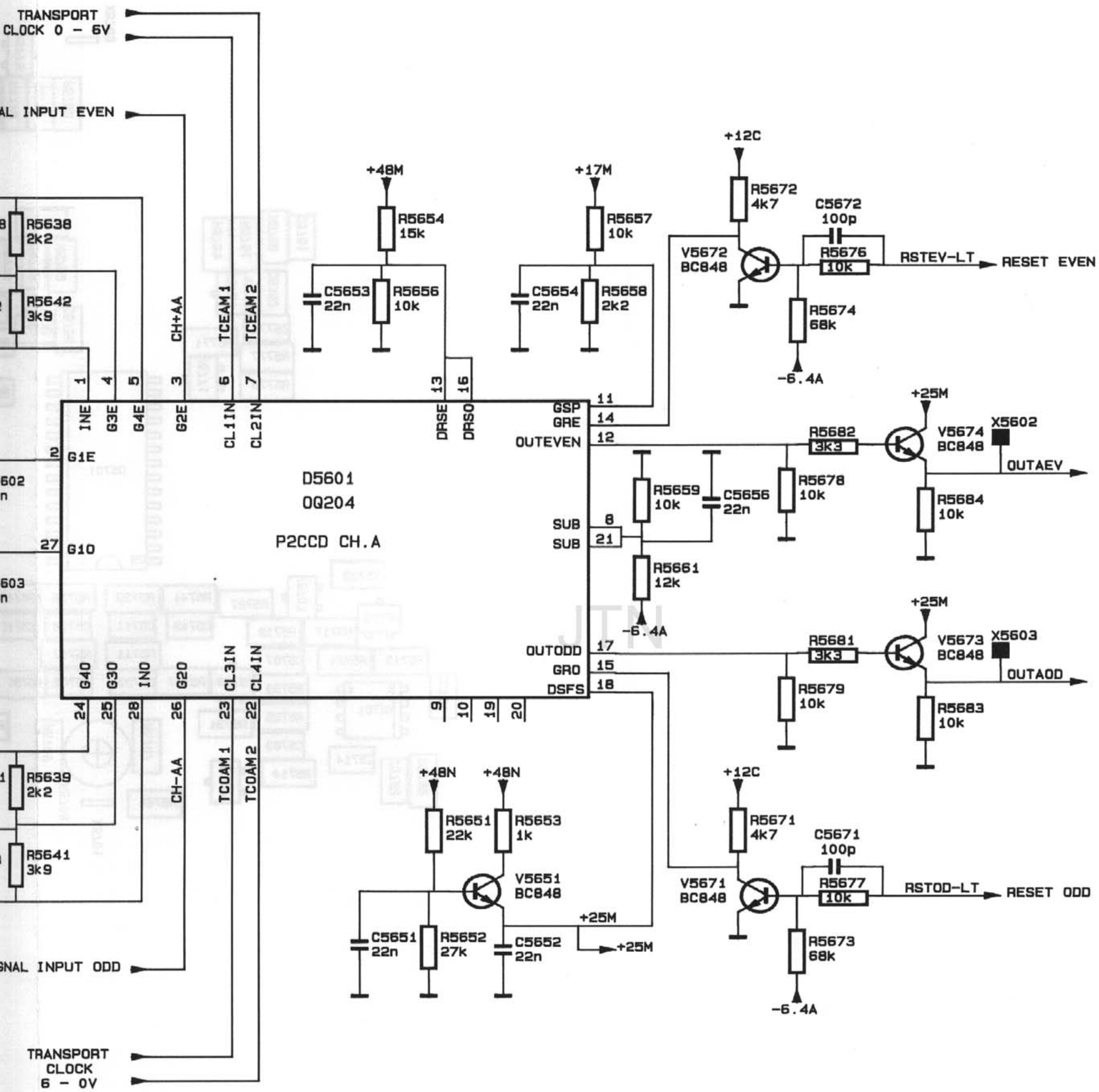
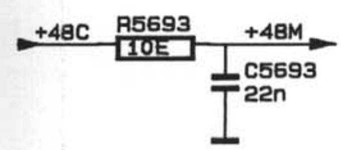


Figure 19.18 Circuit diagram of P^2CCD, P^2CCD channel A

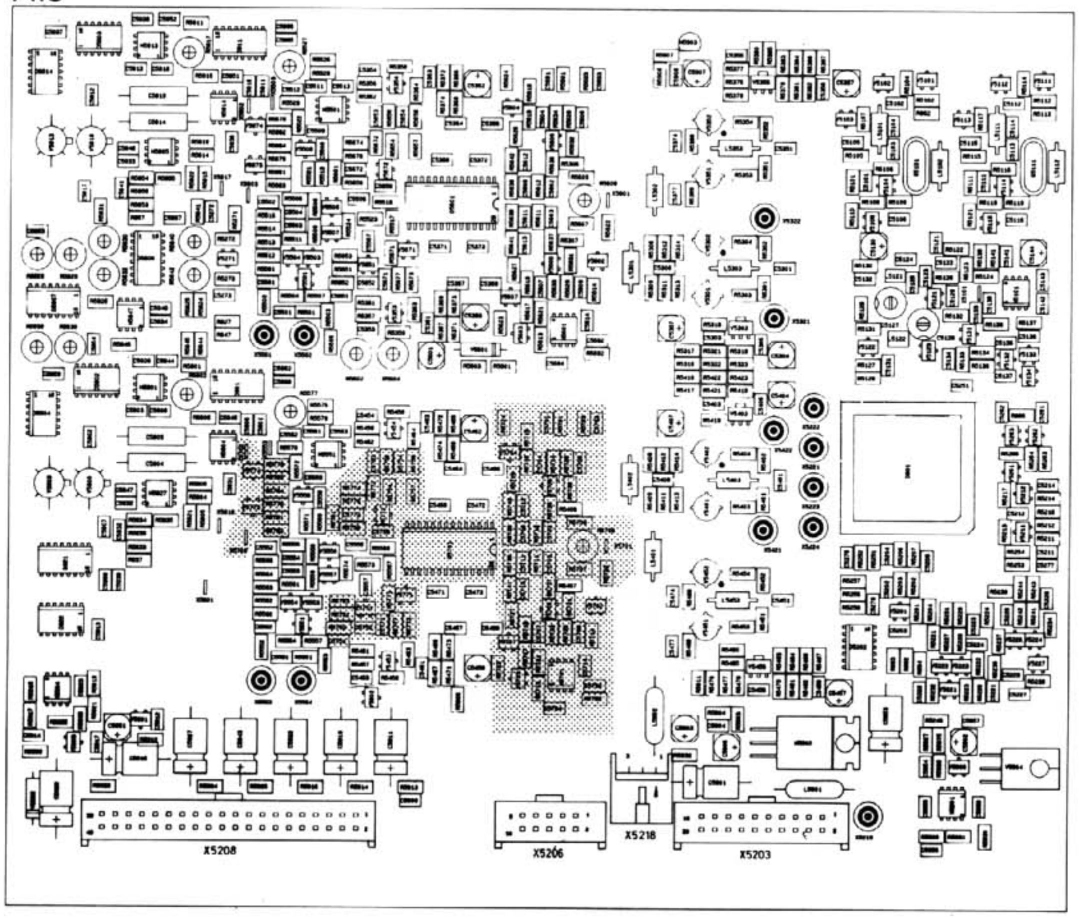


TRANSPORT CLOCK 0 - 6V
AL INPUT EVEN
D5601
OQ204
P2CCD CH.A
RESET EVEN
RESET ODD
OUTAEV
OUTAOD
GNAL INPUT ODD
TRANSPORT CLOCK 6 - 0V

MAT 3800



A18



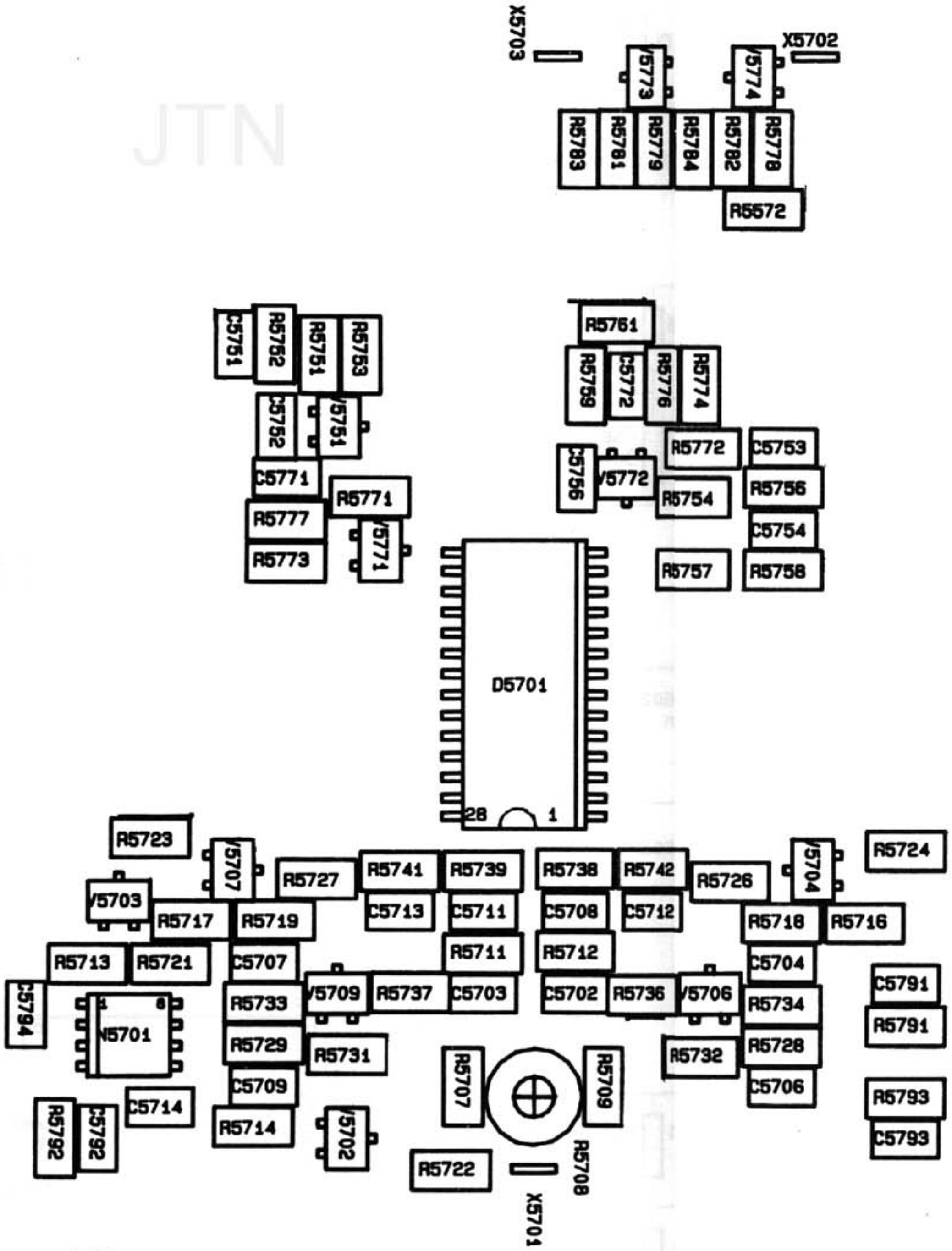


Figure 19.19 Part of P^2CCD unit p.c.b., part 7

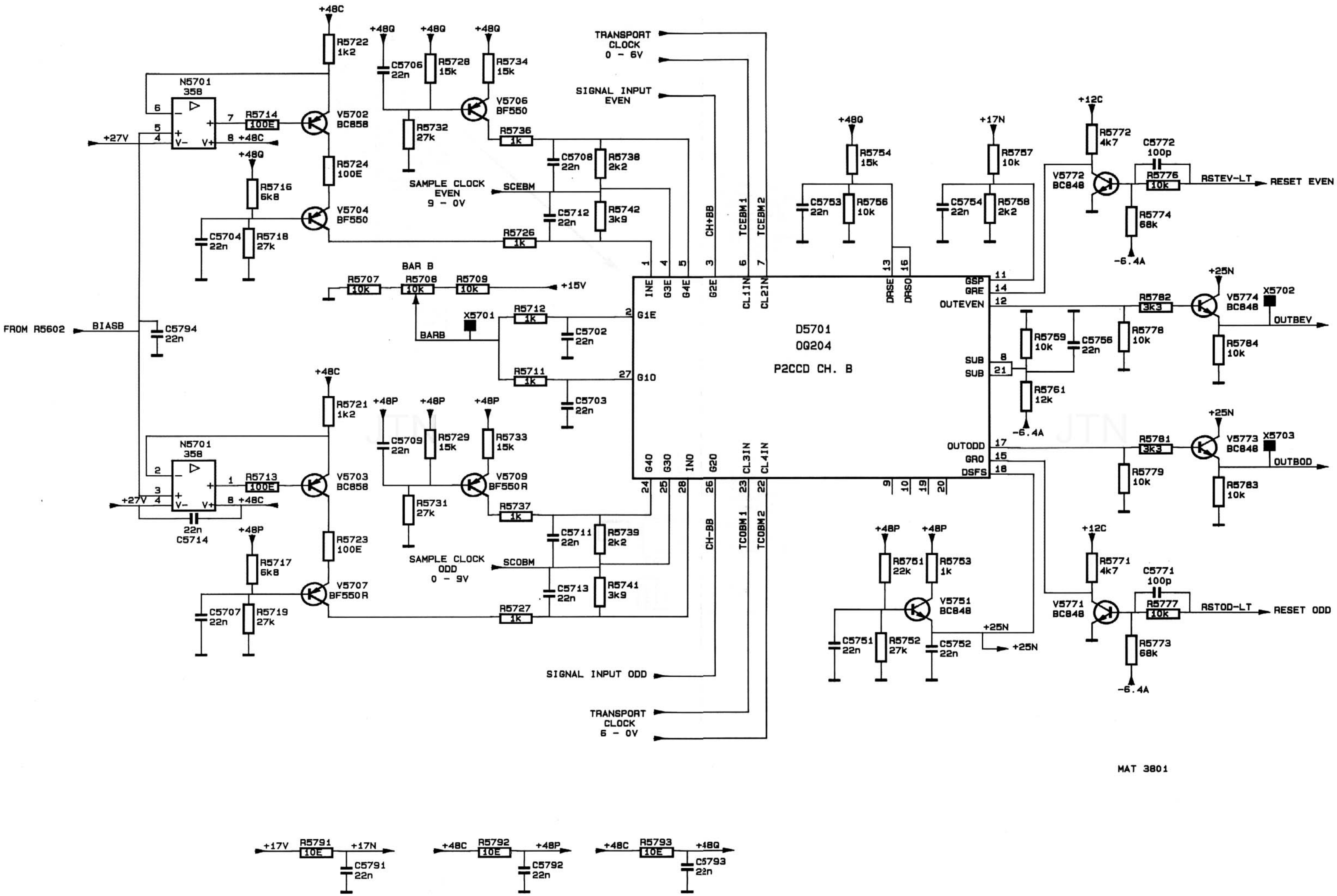


Figure 19.20 Circuit diagram of P^2CCD, P^2CCD channel B

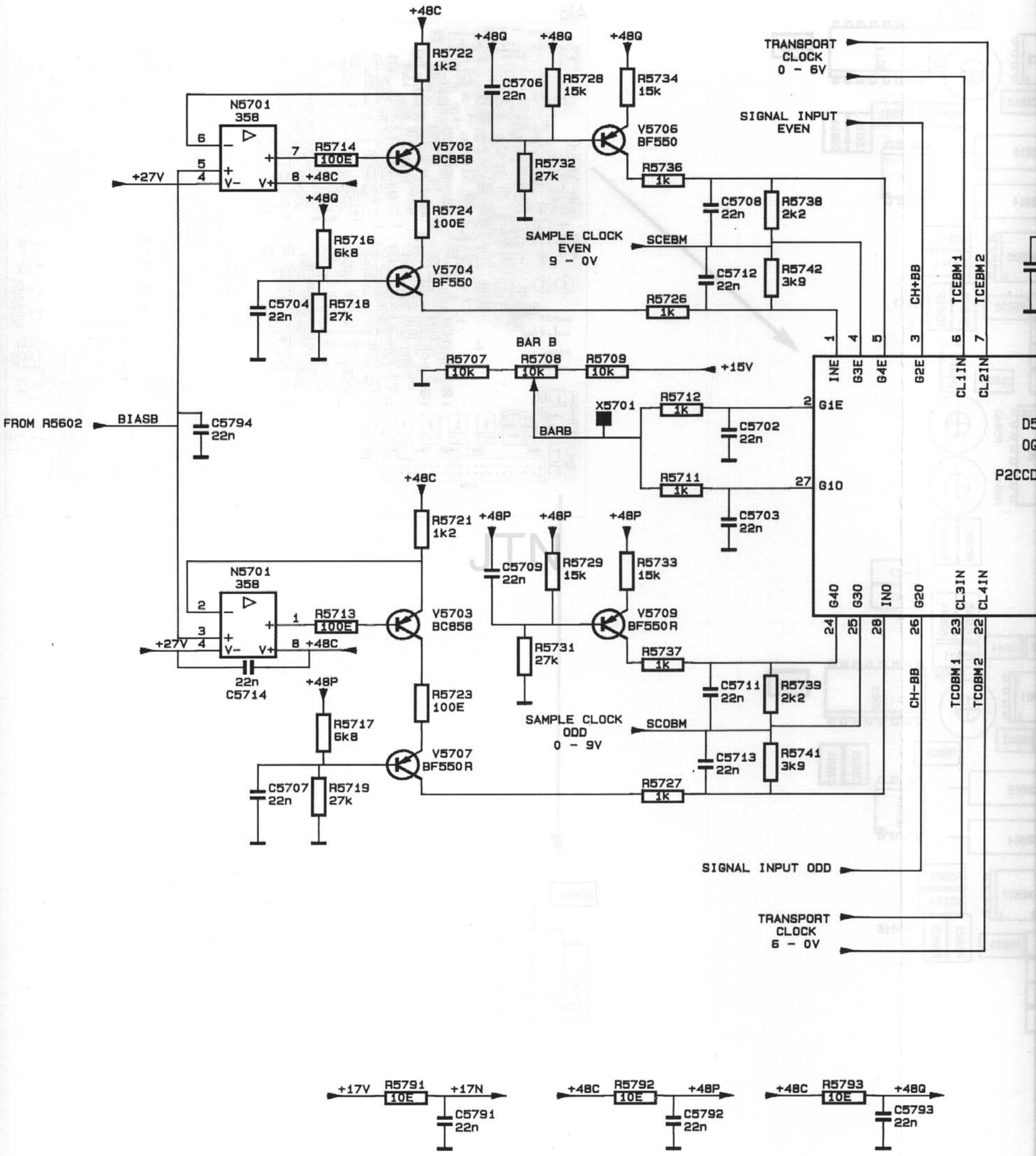
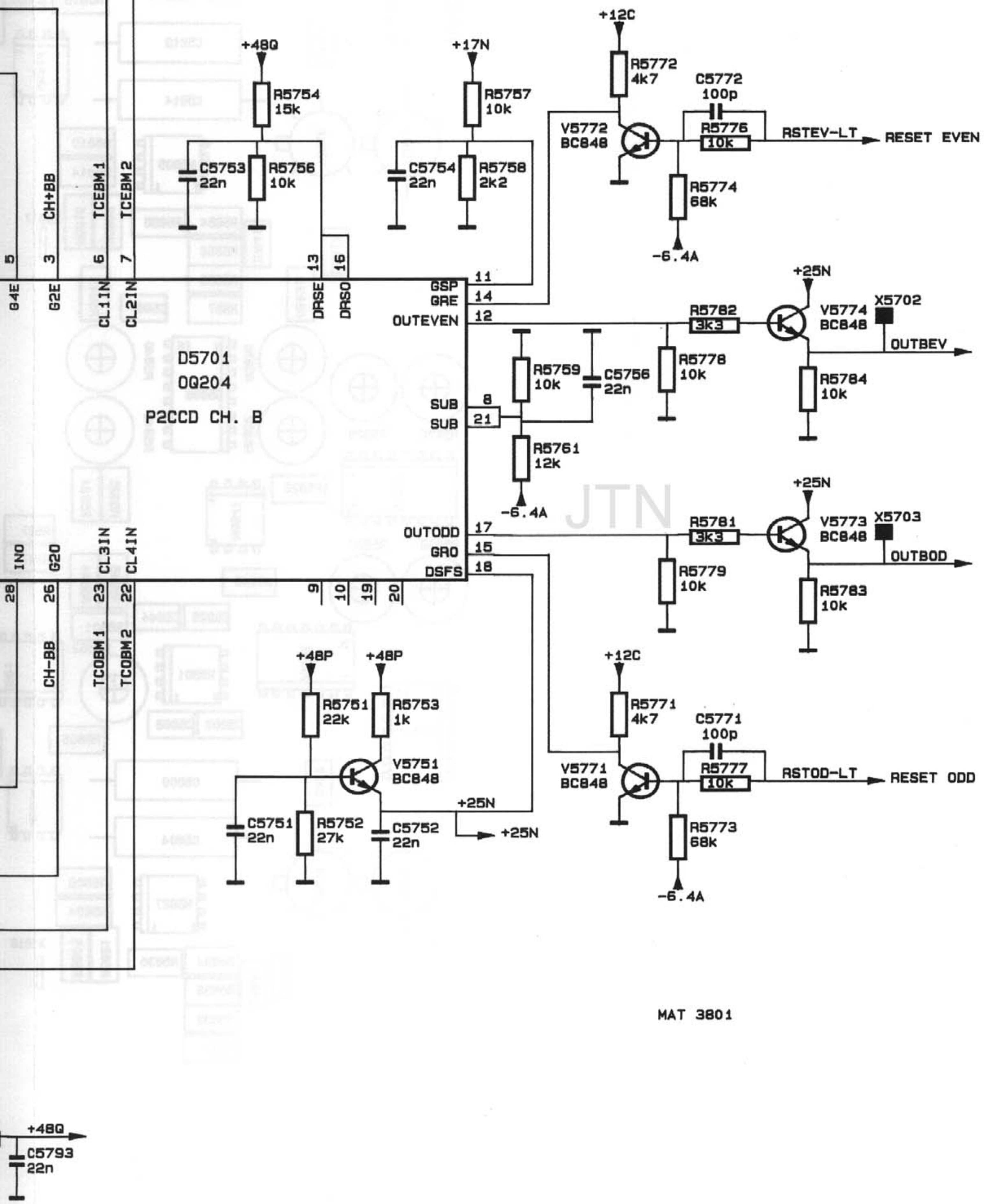
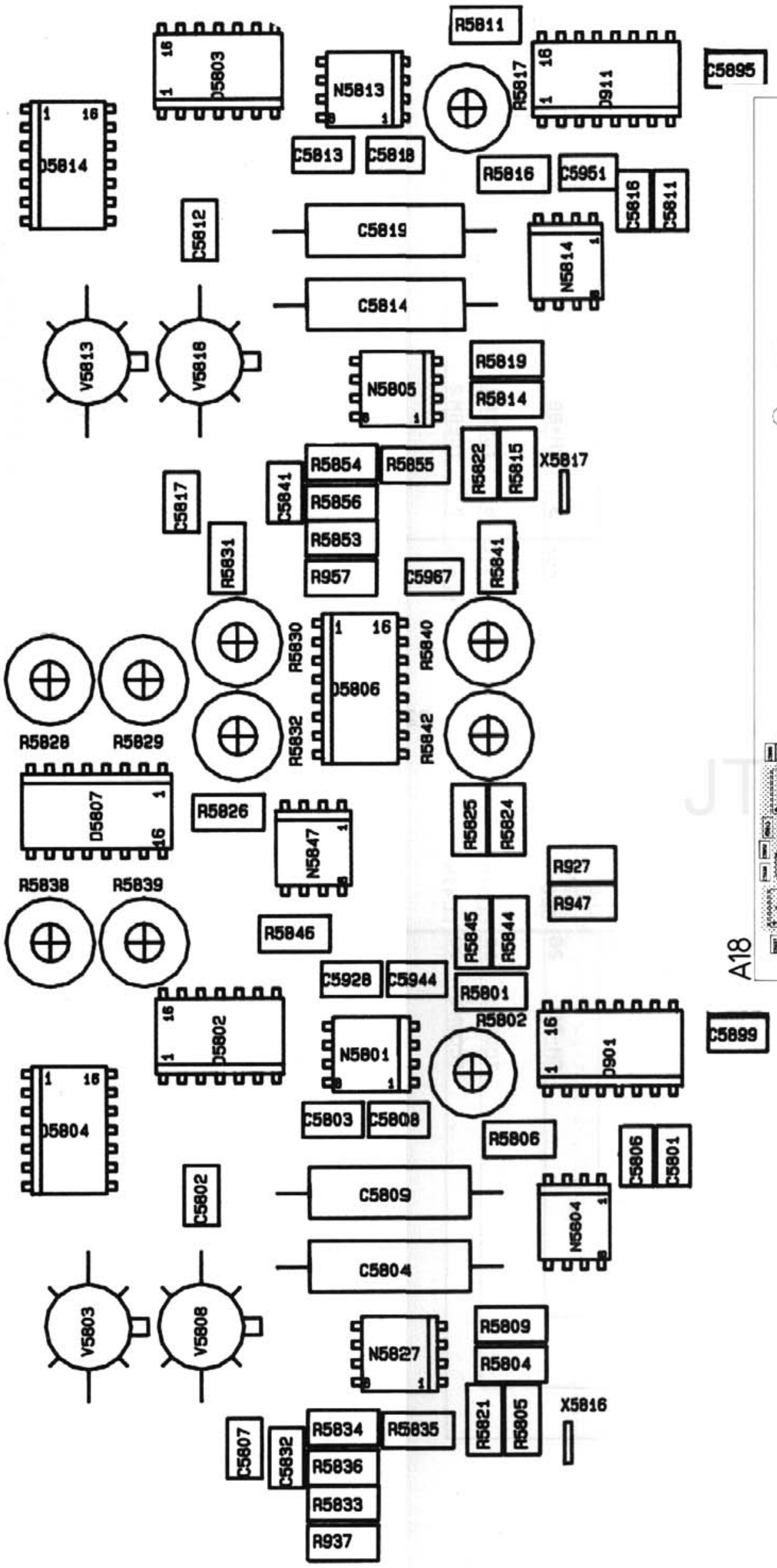


Figure 19.20 Circuit diagram of P^2CCD, P^2CCD channel B



+48Q
R5754
15k
C5753
22n
R5756
10k
+17N
R5757
10k
C5754
22n
R5758
2k2
+12C
R5772
4k7
C5772
100p
V5772
BC848
R5776
10k
RSTEV-LT
RESET EVEN
R5774
68k
-6.4A
CH+BB
TCEBM1
TCEBM2
G4E
G2E
CL1IN
CL2IN
DRSE
DRSO
GSP
GRE
OUTEVEN
D5701
OQ204
P2CCD CH. B
SUB
SUB
+25N
R5782
3k3
V5774
BC848
X5702
OUTBEV
R5778
10k
R5759
10k
C5756
22n
R5784
10k
R5761
12k
-6.4A
OUTODD
GRO
DSFS
R5781
3k3
V5773
BC848
X5703
OUTBOD
R5779
10k
R5783
10k
IN0
G2O
CL3IN
CL4IN
CH-BB
TCOBM1
TCOBM2
+48P
+48P
R5751
22k
R5753
1k
V5751
BC848
C5751
22n
R5752
27k
C5752
22n
+25N
+25N
+12C
R5771
4k7
C5771
100p
V5771
BC848
R5777
10k
RSTOD-LT
RESET ODD
R5773
68k
-6.4A
+48Q
C5793
22n
JTN

MAT 3801



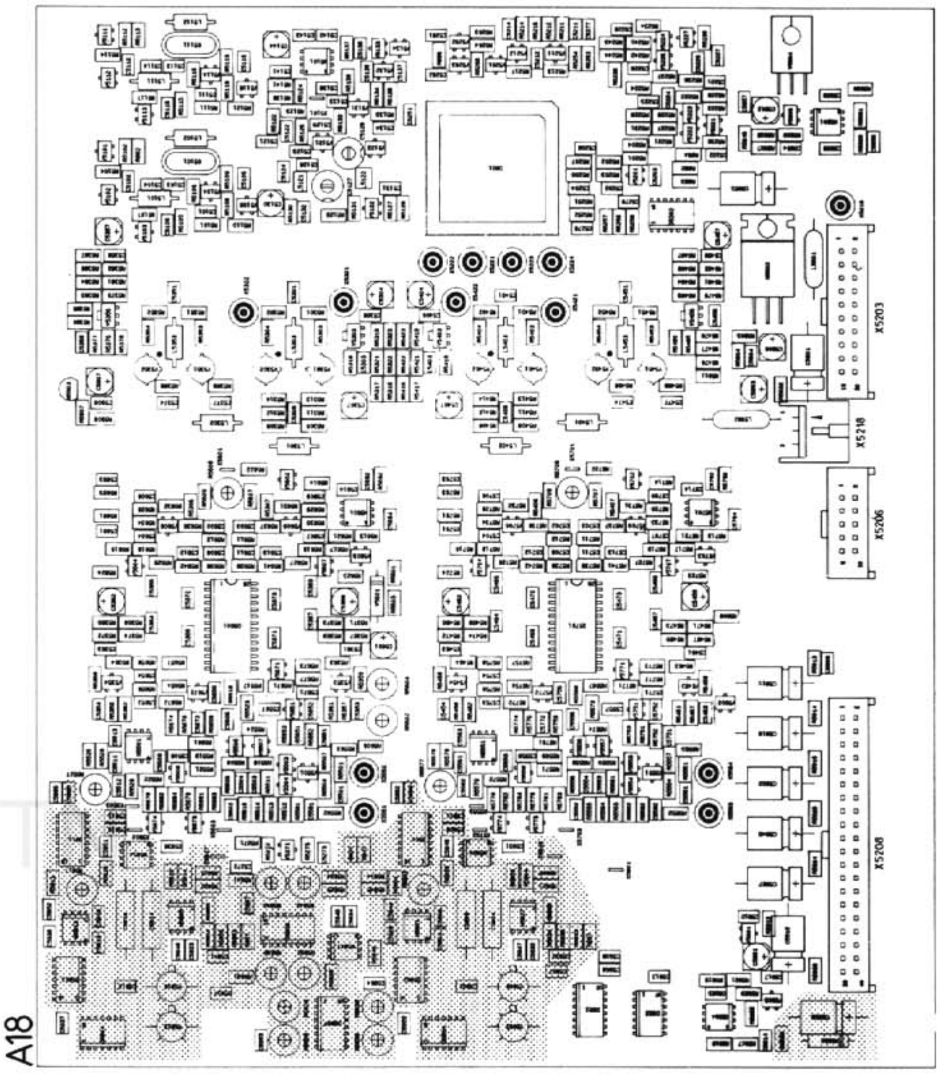
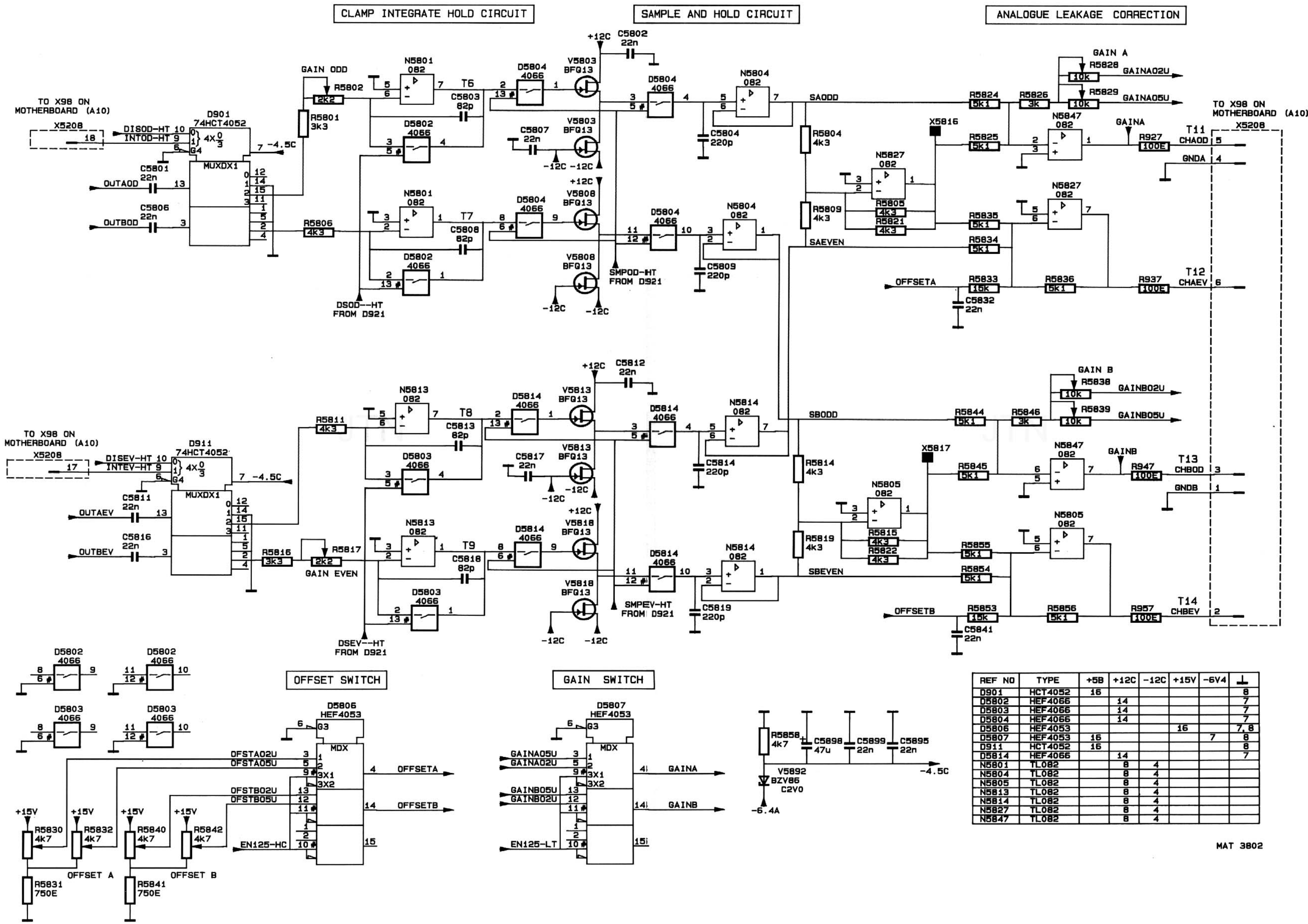


Figure 19.21 Part of P^2CCD unit p.c.b., part 8



REF NO	TYPE	+5B	+12C	−12C	+15V	−6V4	⊥
D901	HCT4052	16					8
D5802	HEF4066		14				7
D5803	HEF4066		14				7
D5804	HEF4066		14				7
D5806	HEF4053				16		7, 8
D5807	HEF4053	16				7	8
D911	HCT4052	16					8
D5814	HEF4066		14				7
N5801	TL082		8	4			
N5804	TL082		8	4			
N5805	TL082		8	4			
N5813	TL082		8	4			
N5814	TL082		8	4			
N5827	TL082		8	4			
N5847	TL082		8	4			

Figure 19.22 Circuit diagram of P^2CCD, CIH circuit

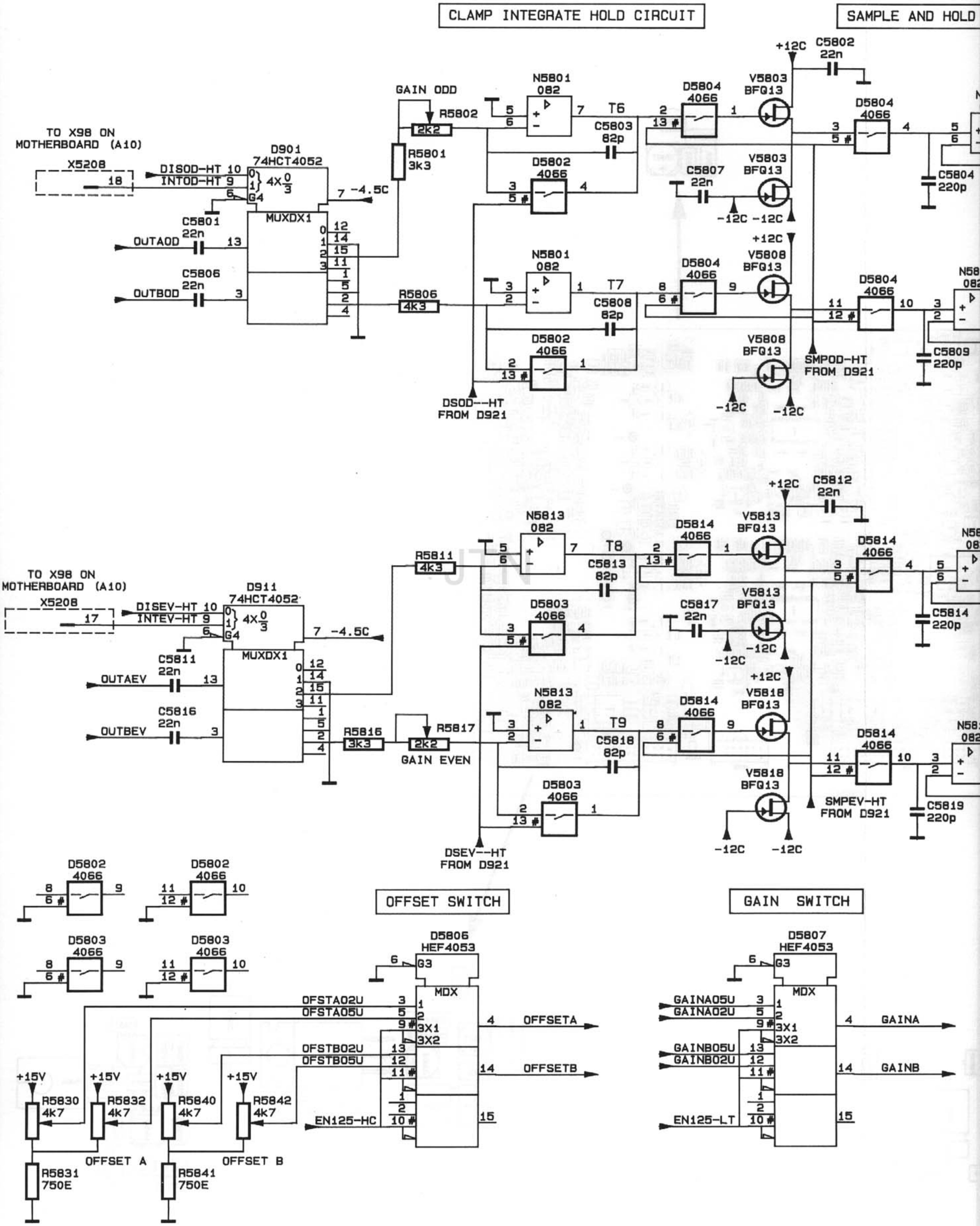
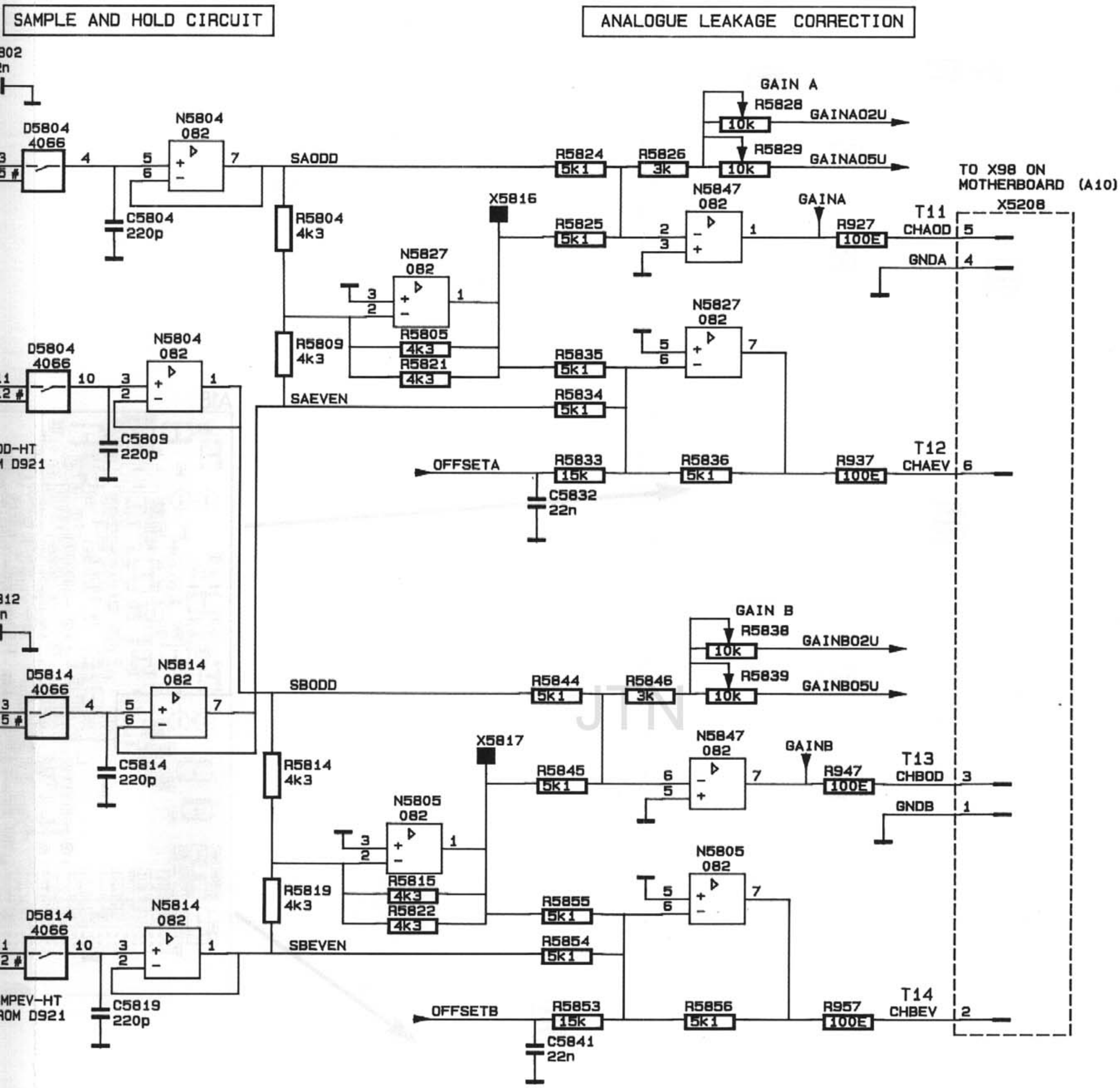
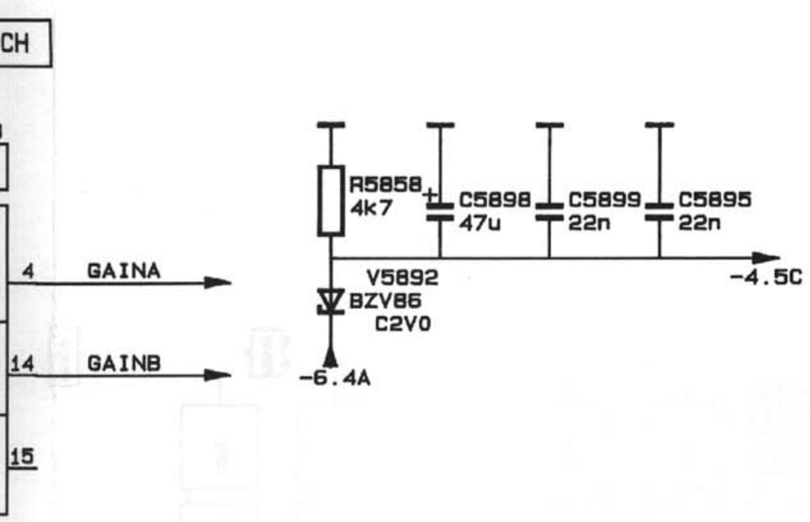


Figure 19.22 Circuit diagram of P^2CCD, CIH circuit





REF NO	TYPE	+5B	+12C	-12C	+15V	-6V4	⊥
D901	HCT4052	16					8
D5802	HEF4066		14				7
D5803	HEF4066		14				7
D5804	HEF4066		14				7
D5806	HEF4053				16		7, 8
D5807	HEF4053	16				7	8
D911	HCT4052	16					8
D5814	HEF4066		14				7
N5801	TL082		8	4			
N5804	TL082		8	4			
N5805	TL082		8	4			
N5813	TL082		8	4			
N5814	TL082		8	4			
N5827	TL082		8	4			
N5847	TL082		8	4			

MAT 3802

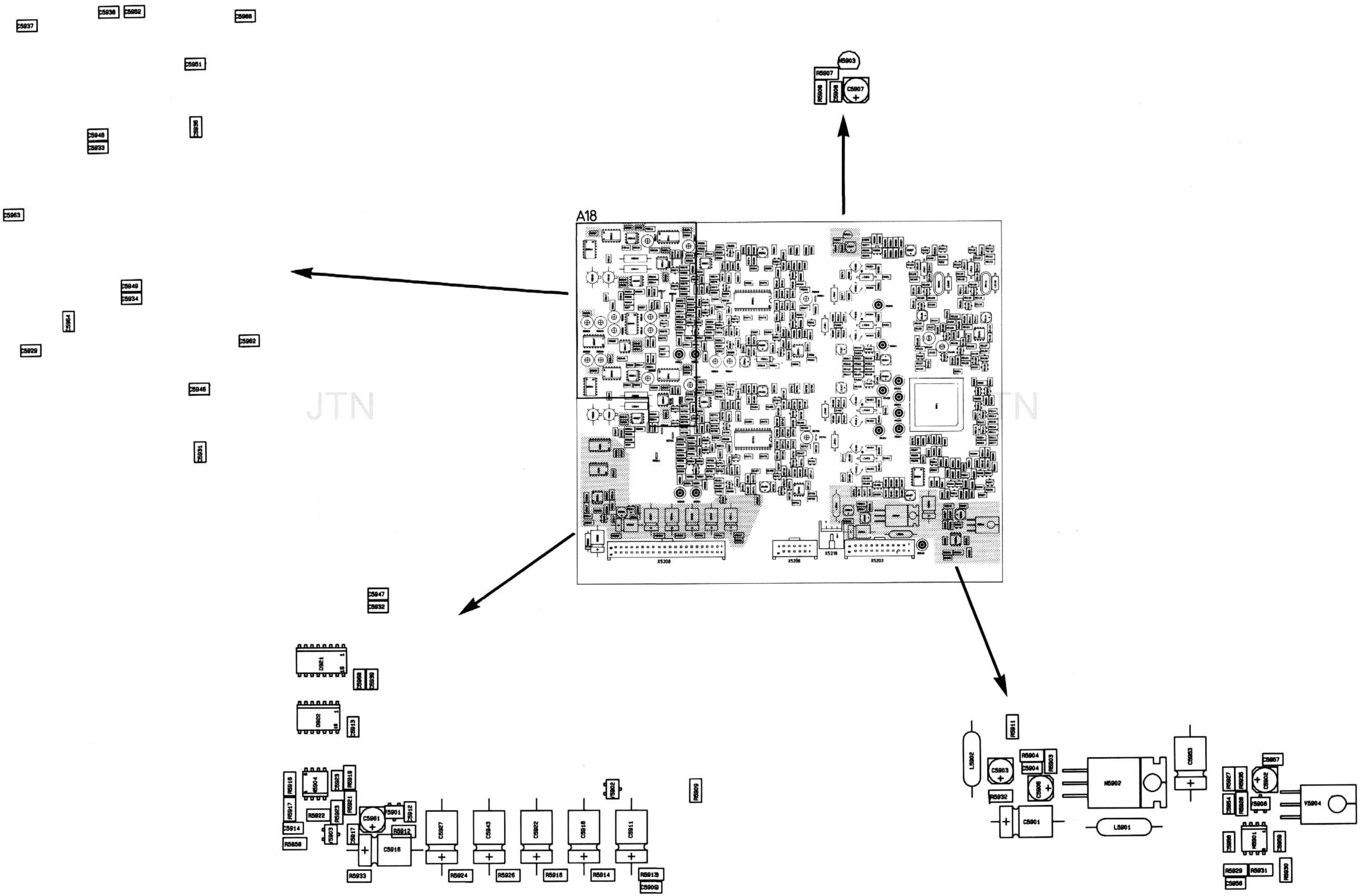


Figure 19.23 Part of P^2CCD unit p.c.b., part 9

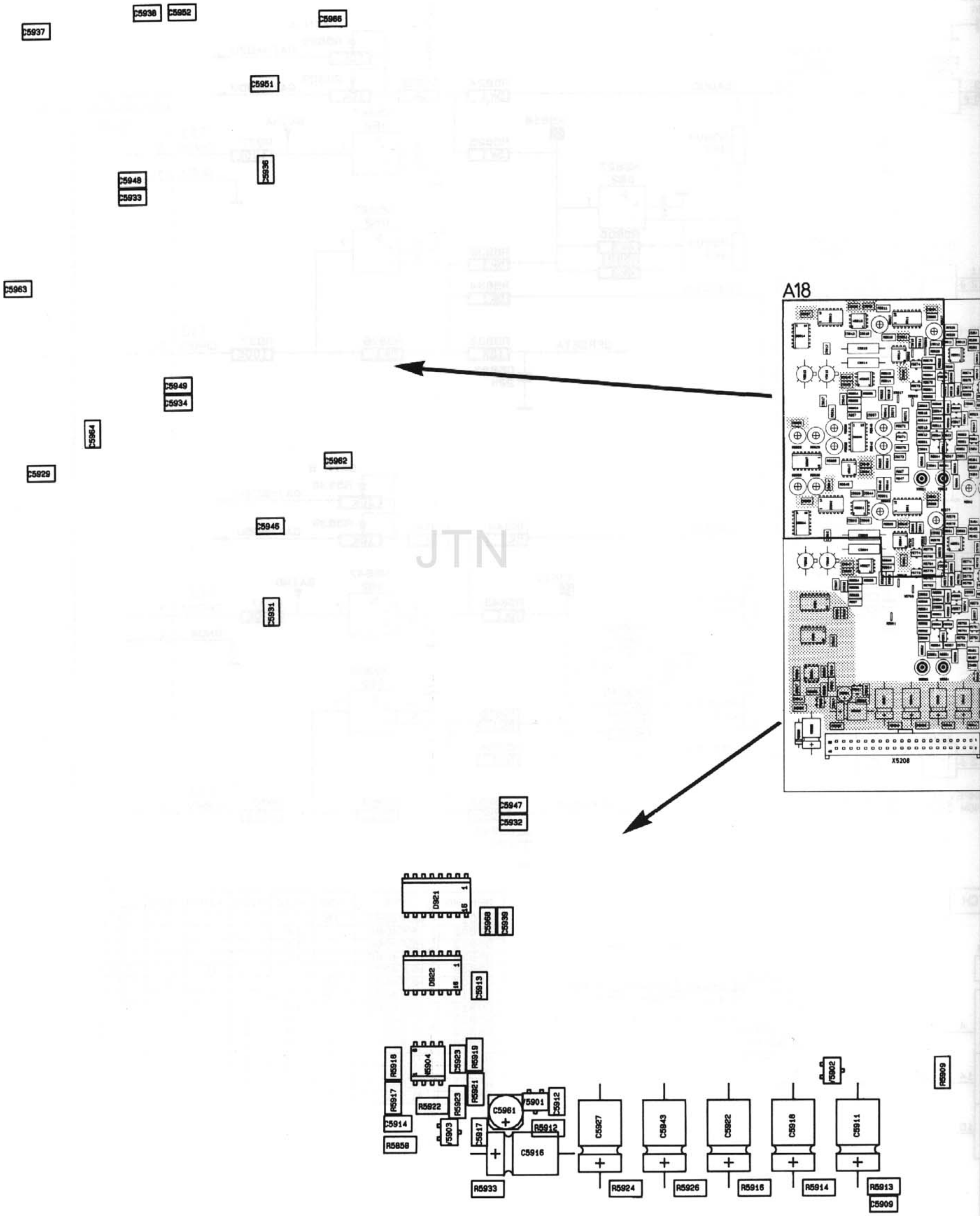
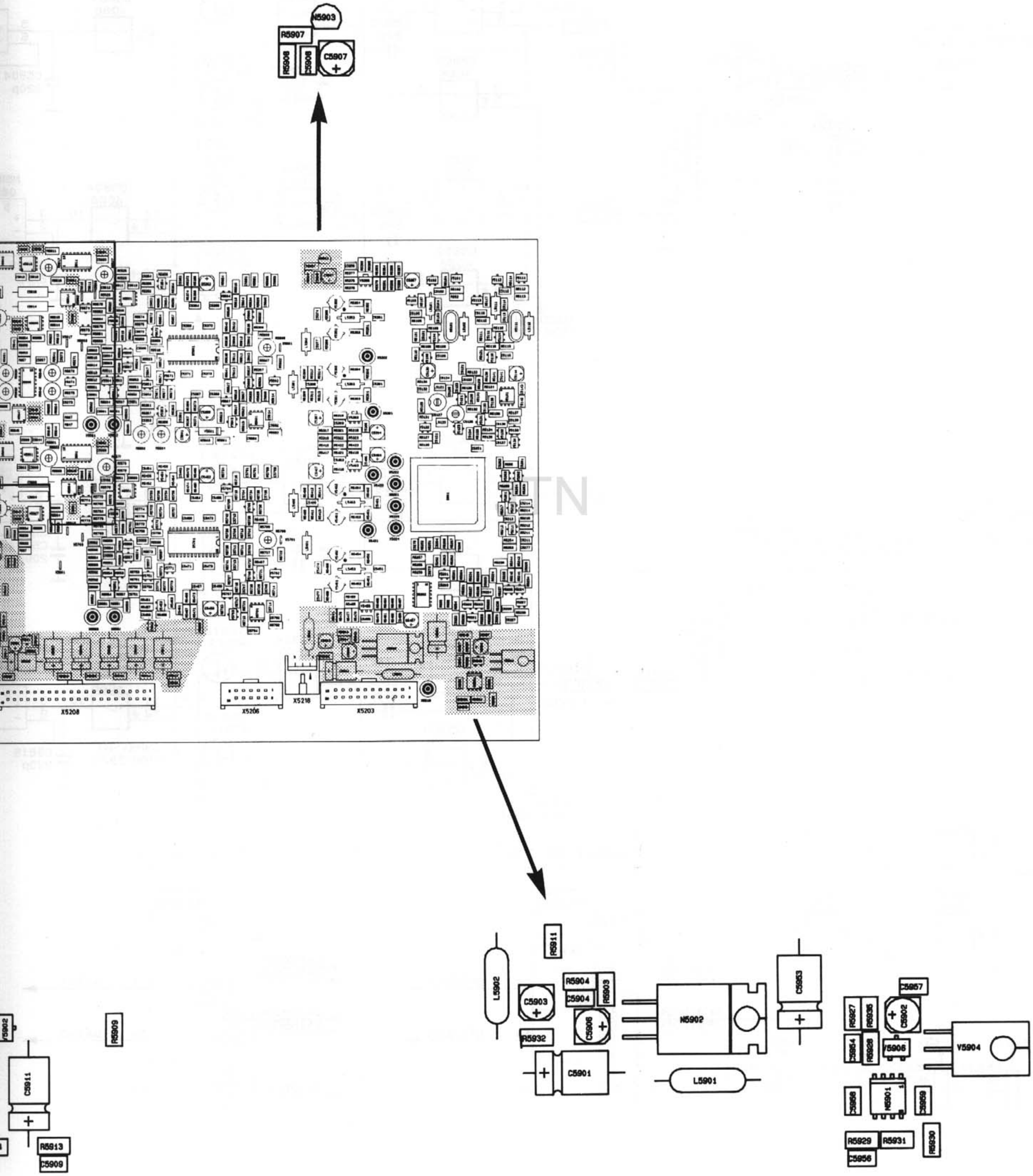
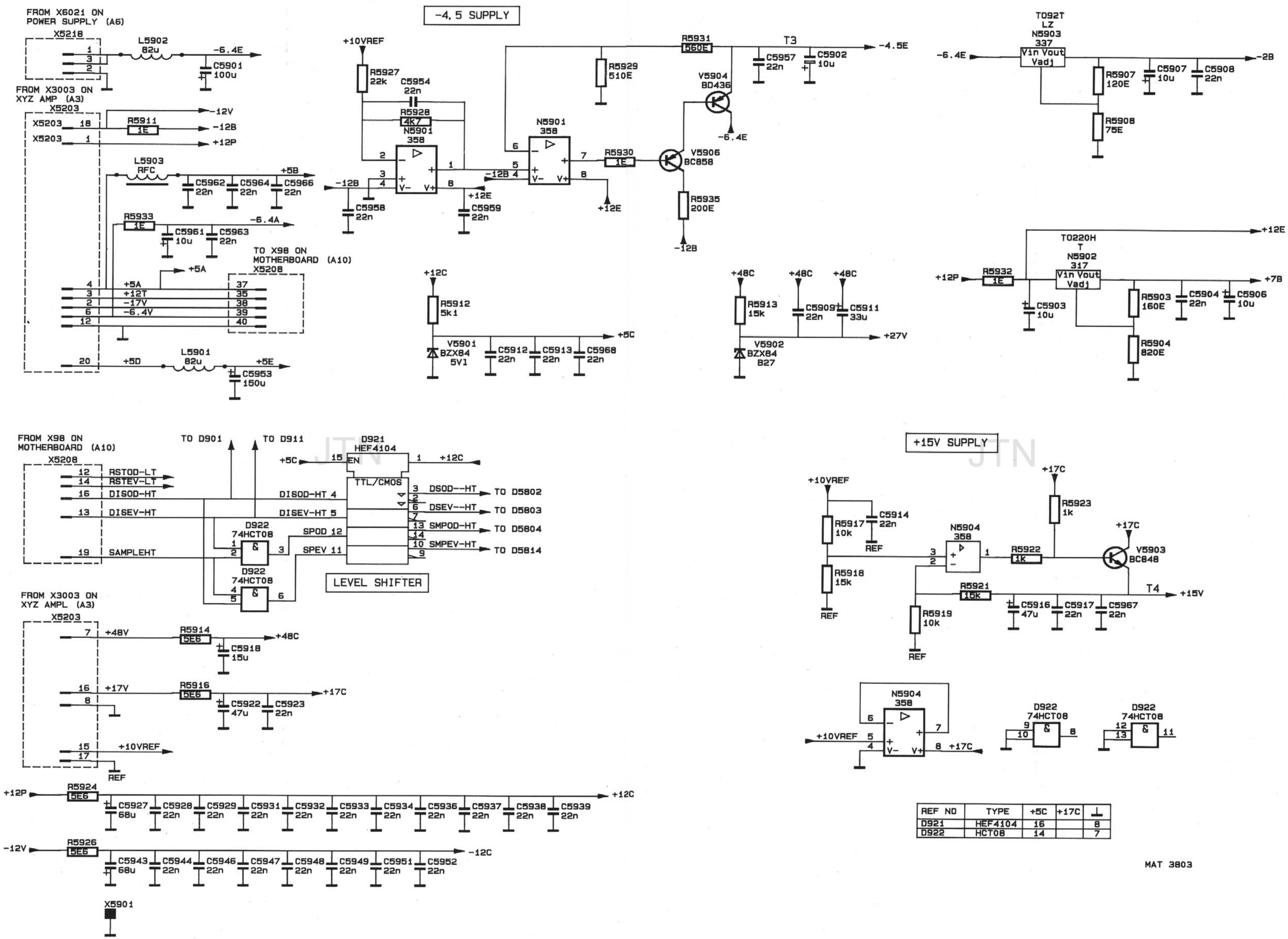


Figure 19.23 Part of P^2CCD unit p.c.b., part 9



N5903
R5907
R5908
C5907
X5208
X5206
X5218
X5203
R5911
L5902
R5904
R5903
C5903
C5904
C5906
N5902
C5953
R5932
C5901
L5901
C5957
R5927
R5935
C5902
C5954
R5928
V5906
V5904
C5958
N5901
C5959
R5929
R5931
R5930
C5956
C5911
R5909
R5913
C5909



REF NO	TYPE	+5C	+17C	⊥
D921	HEF4104	16		8
D922	HCT08	14		7

Figure 19.24 Circuit diagram of P^2CCD, power supplies and level shifter

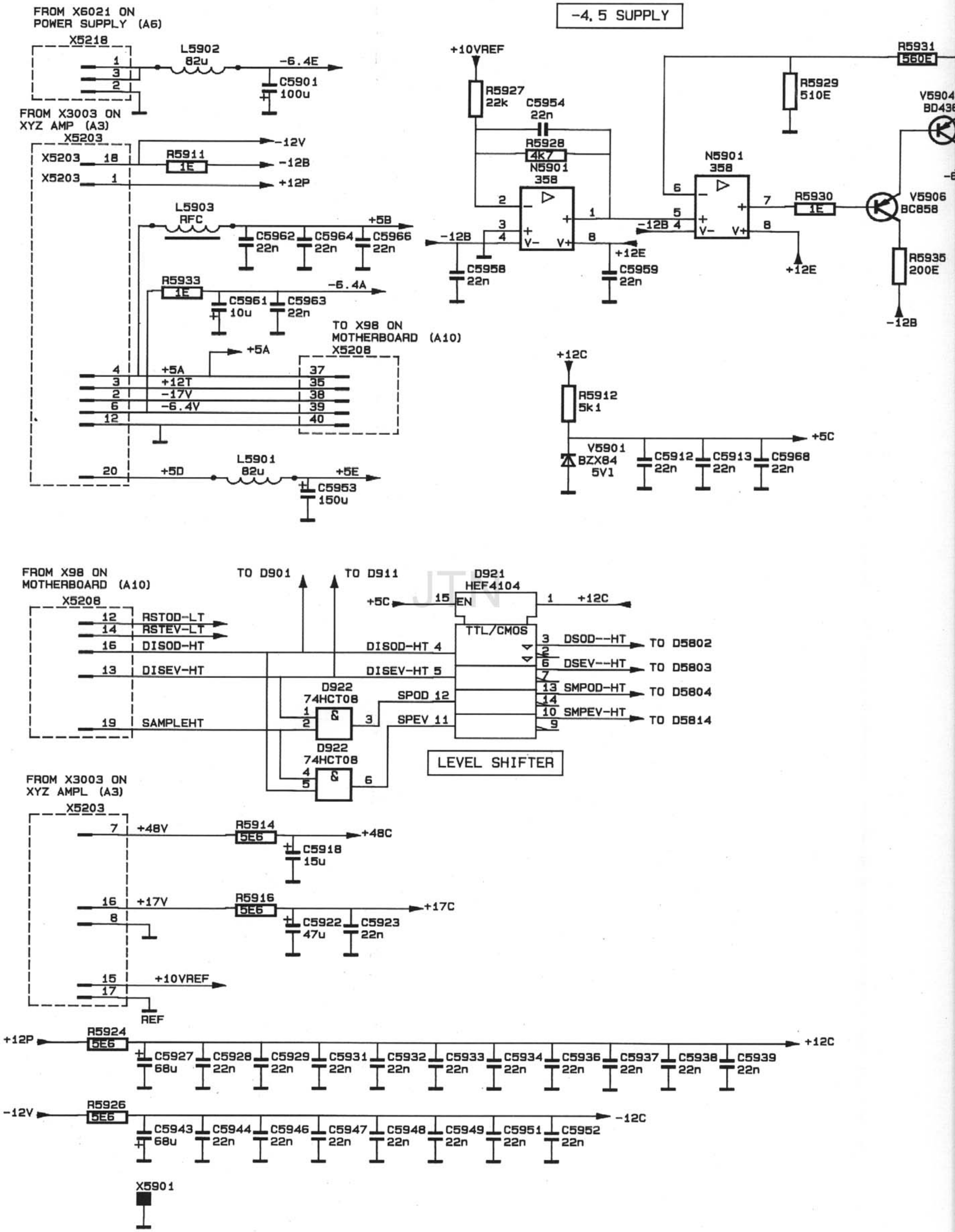
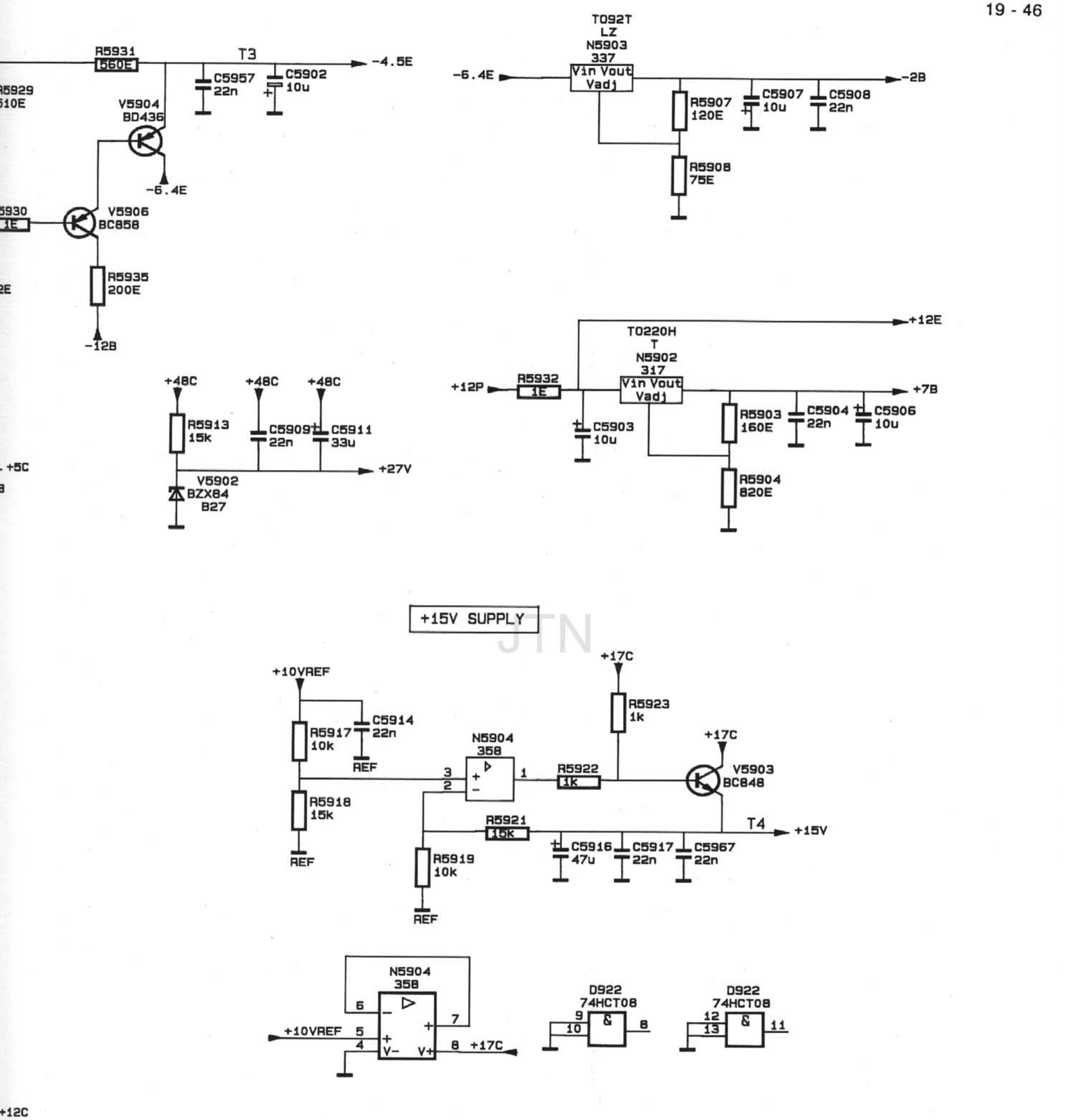


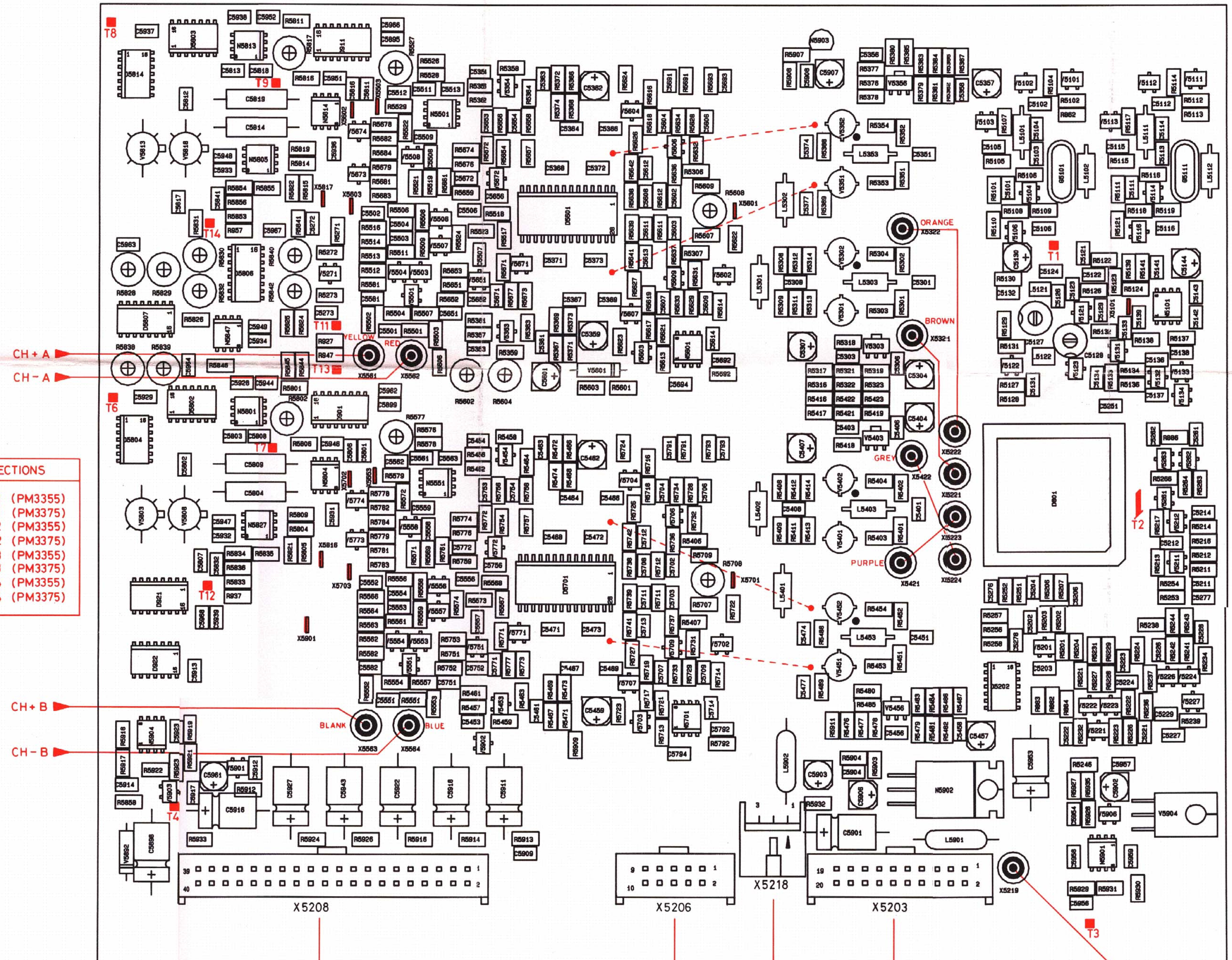
Figure 19.24 Circuit diagram of P^2CCD, power supplies and level shifter



REF NO	TYPE	+5C	+17C	⊥
D921	HEF4104	16		8
D922	HCT08	14		7

MAT 3803

A18



TEST PIN	SIGNAL	ADJUSTING ELEMENT
X5101	RES. INDICATION	C5127/28
X5503	DC LEVEL A	R5527
X5553	DC LEVEL B	R5577
X5601	BAR A	R5608
X5701	BAR B	R5708
X5602	OUTAEV	R5604
X5603	OUTAOD	R5604
X5702	OUTBEV	R5602
X5703	OUTBOD	R5602
X5816	LEAKAGE A	R5802
X5818	LEAKAGE B	R5817
X5901	GND	

ADJUSTING ELEMENTS:

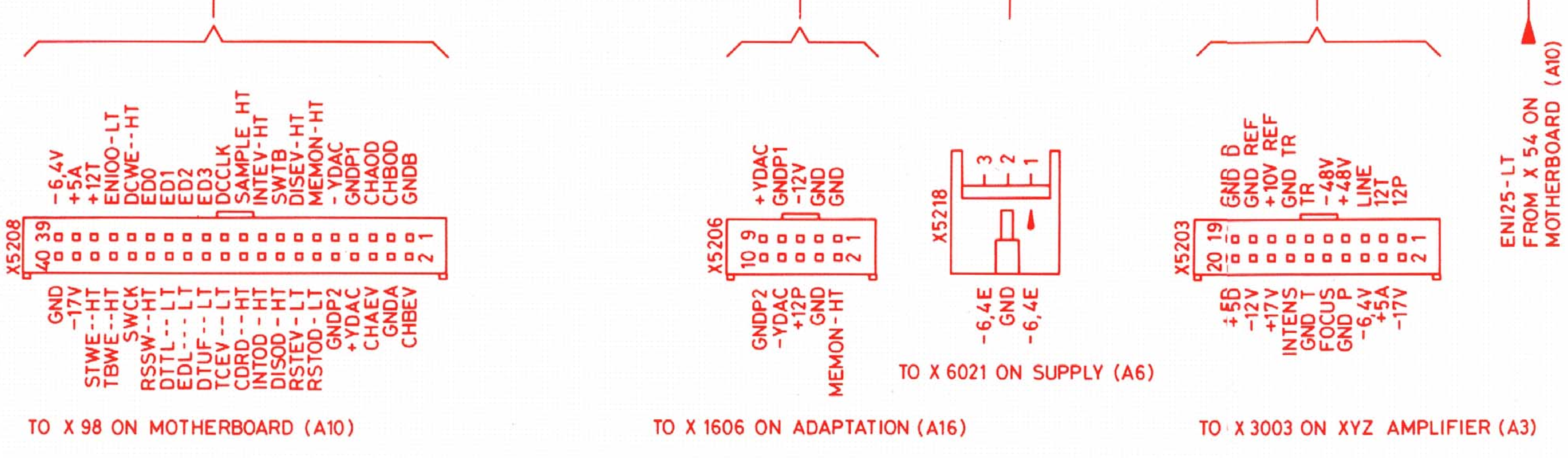
C5127	RESONANCE 250 MHz
C5128	RESONANCE 200 MHz
R5527	DC LEVEL A
R5577	DC LEVEL B
R5604	BIAS A
R5602	BIAS B
R5608	BAR A
R5708	BAR B
R5817	GAIN EVEN
R5802	GAIN ODD
R5828	GAIN A 200 NS
R5829	GAIN A
R5838	GAIN B 200 NS
R5839	GAIN B
R5830	OFFSET A 200 NS
R5832	OFFSET A
R5840	OFFSET B 200 NS
R5842	OFFSET B

TESTPADS:

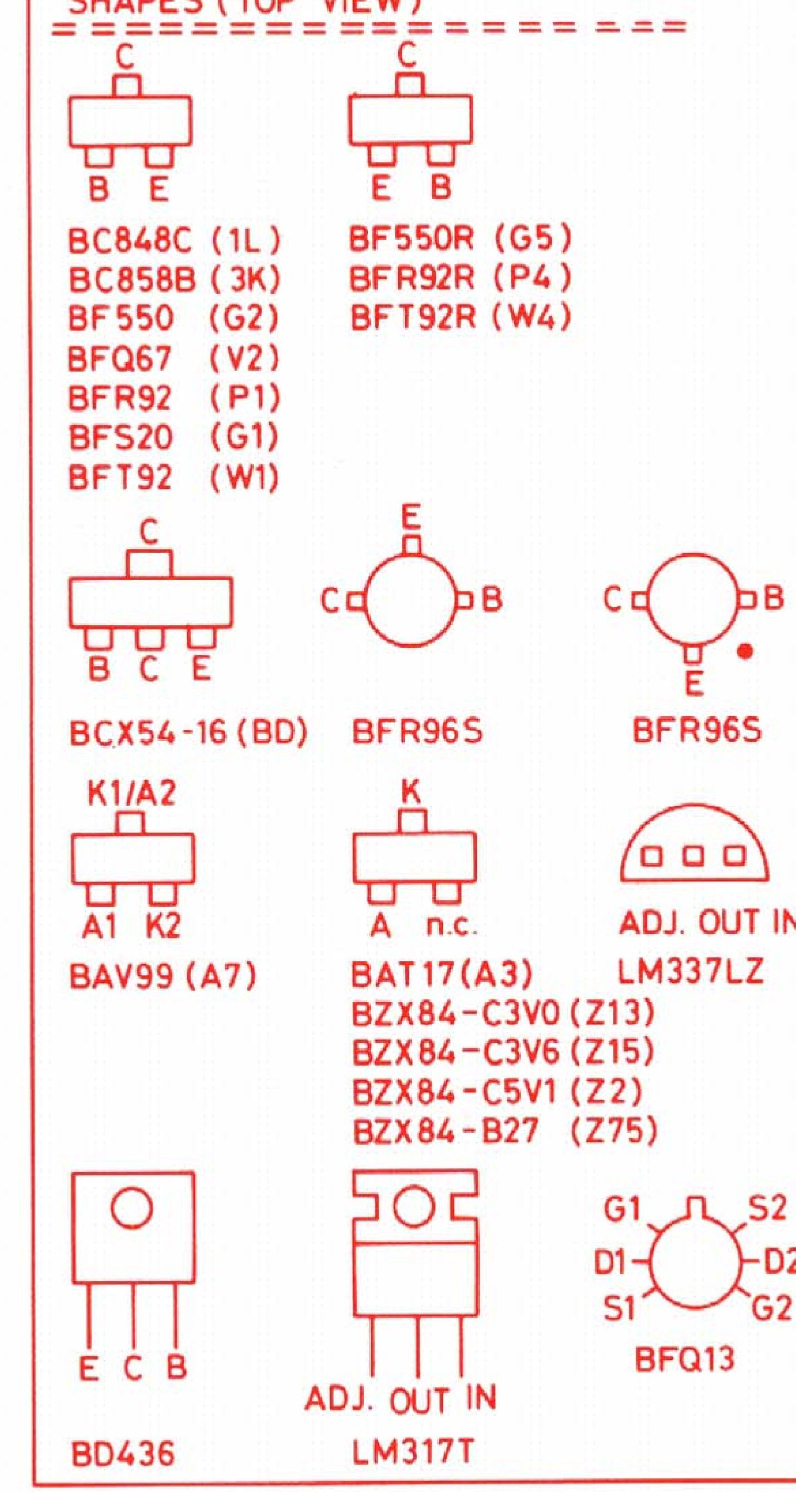
T1	100 MHz OR 125 MHz
T2	CLOCK OUT CK200250 (1 Vp-p SINE-WAVE)
T3	-4,5V
T4	+15V
T6, T7, T8, T9	Ux
T11	CHAOD OUTPUT
T12	CHAEV OUTPUT
T13	CHBOD OUTPUT
T14	CHBEV OUTPUT

50Ω CABLE CONNECTIONS

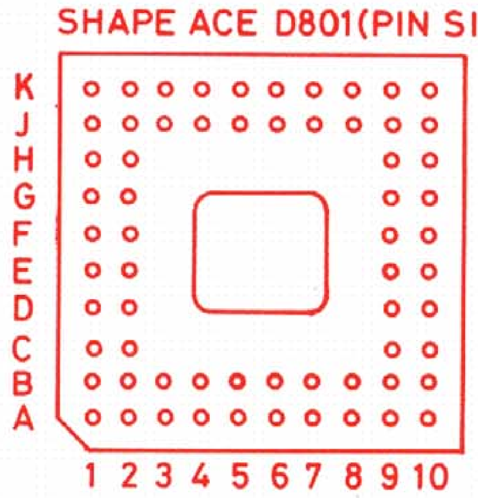
X5561	FROM X 661	(PM3355)
	FROM X1661	(PM3375)
X5562	FROM X 662	(PM3355)
	FROM X1662	(PM3375)
X5563	FROM X 663	(PM3355)
	FROM X1663	(PM3375)
X5564	FROM X 664	(PM3355)
	FROM X1664	(PM3375)



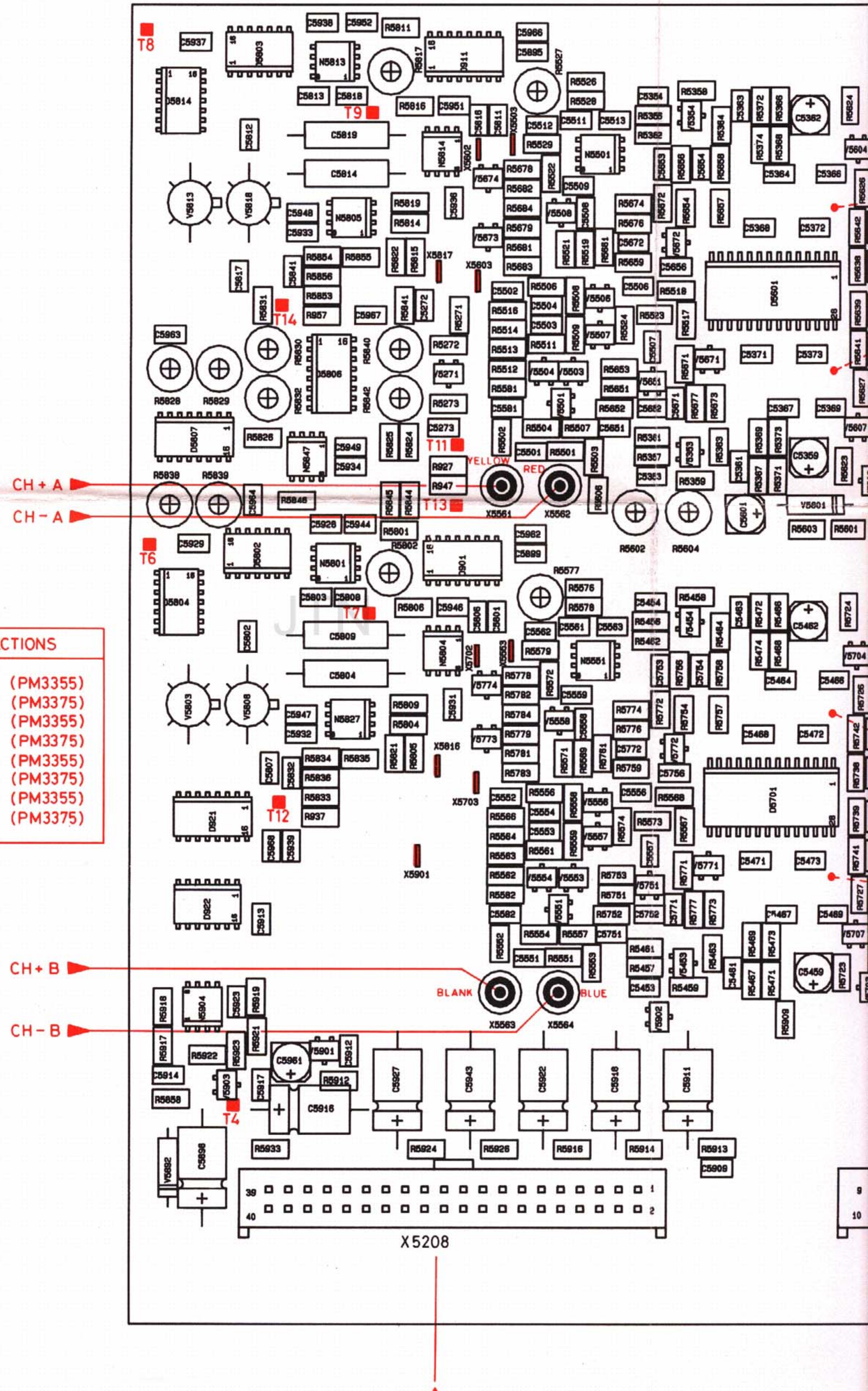
SHAPES (TOP VIEW)



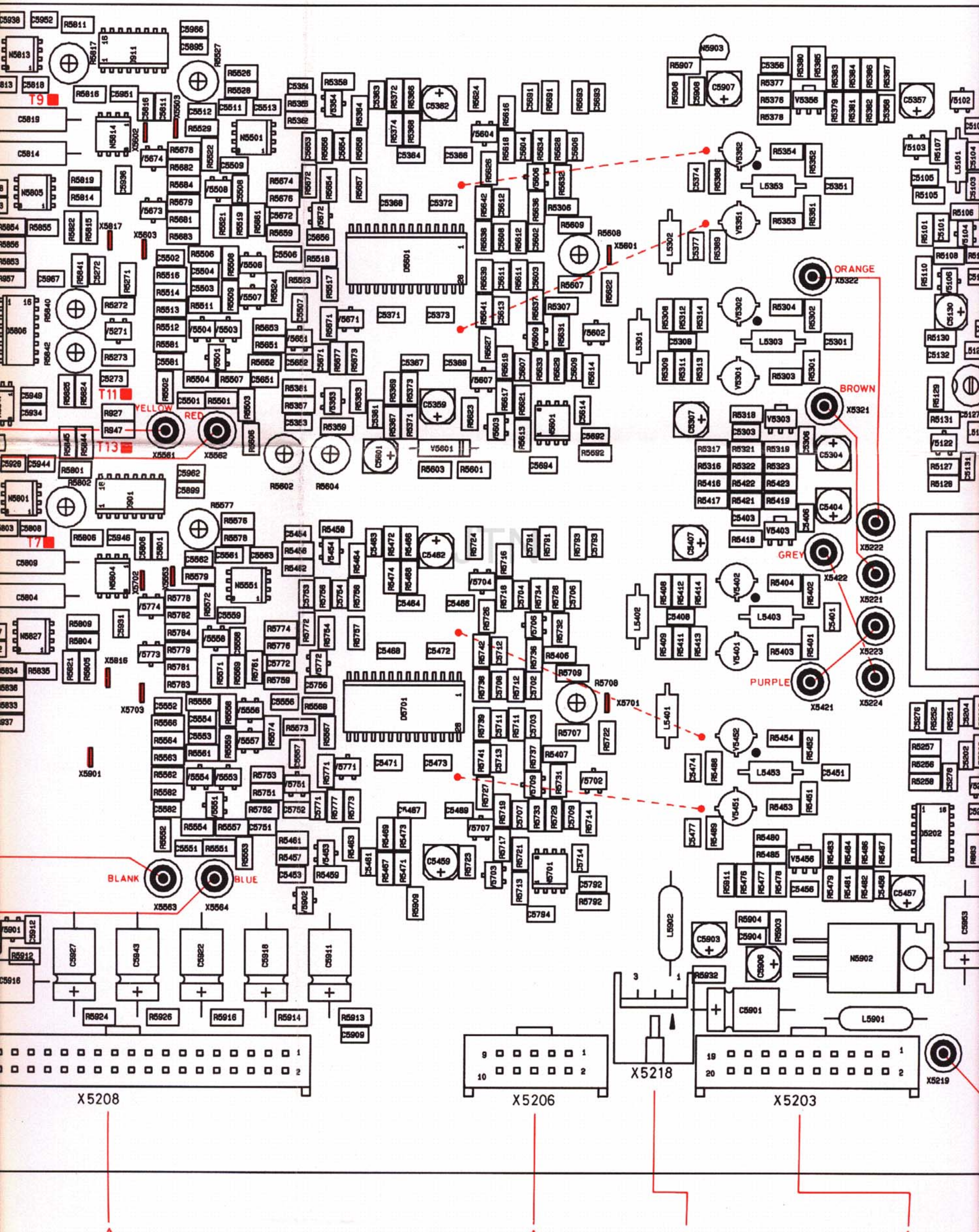
SHAPE ACE D801(PIN SIDE VIEW)



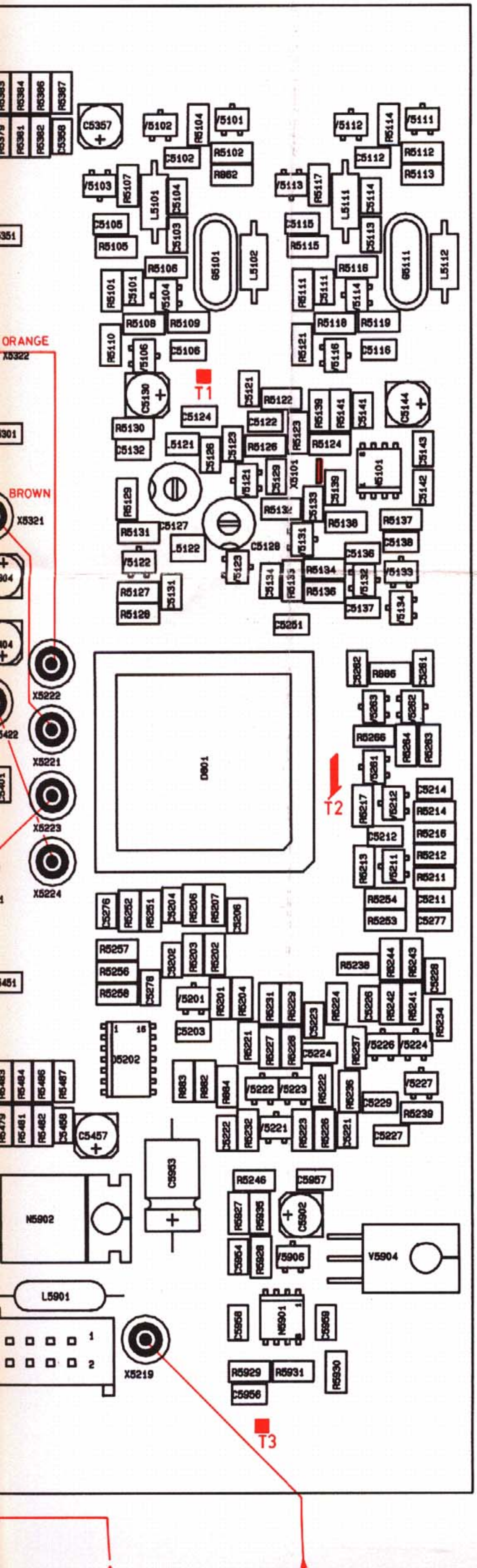
A18



50Ω CABLE CONNECTIONS		
X5561	FROM X 661	(PM3355)
	FROM X1661	(PM3375)
X5562	FROM X 662	(PM3355)
	FROM X1662	(PM3375)
X5563	FROM X 663	(PM3355)
	FROM X1663	(PM3375)
X5564	FROM X 664	(PM3355)
	FROM X1664	(PM3375)



T9
T11
T13
T7
YELLOW
RED
X5561
X5562
BLANK
BLUE
X5563
X5564
ORANGE
X5322
BROWN
X5321
GREY
X5422
X5222
X5221
X5223
PURPLE
X5421
X5224
X5208
X5206
X5218
X5203
X5219



TEST PIN	SIGNAL	ADJUSTING ELEMENT
X5101	RES. INDICATION	C5127/28
X5503	DC LEVEL A	R5527
X5553	DC LEVEL B	R5577
X5601	BAR A	R5608
X5701	BAR B	R5708
X5602	OUTAEV	R5604
X5603	OUTAOD	R5604
X5702	OUTBEV	R5602
X5703	OUTBOD	R5602
X5816	LEAKAGE A	R5802
X5818	LEAKAGE B	R5817
X5901	GND	

ADJUSTING ELEMENTS:

C5127	RESONANCE 250 MHz
C5128	RESONANCE 200 MHz
R5527	DC LEVEL A
R5577	DC LEVEL B
R5604	BIAS A
R5602	BIAS B
R5608	BAR A
R5708	BAR B
R5817	GAIN EVEN
R5802	GAIN ODD
R5828	GAIN A 200 NS
R5829	GAIN A
R5838	GAIN B 200 NS
R5839	GAIN B
R5830	OFFSET A 200 NS
R5832	OFFSET A
R5840	OFFSET B 200 NS
R5842	OFFSET B

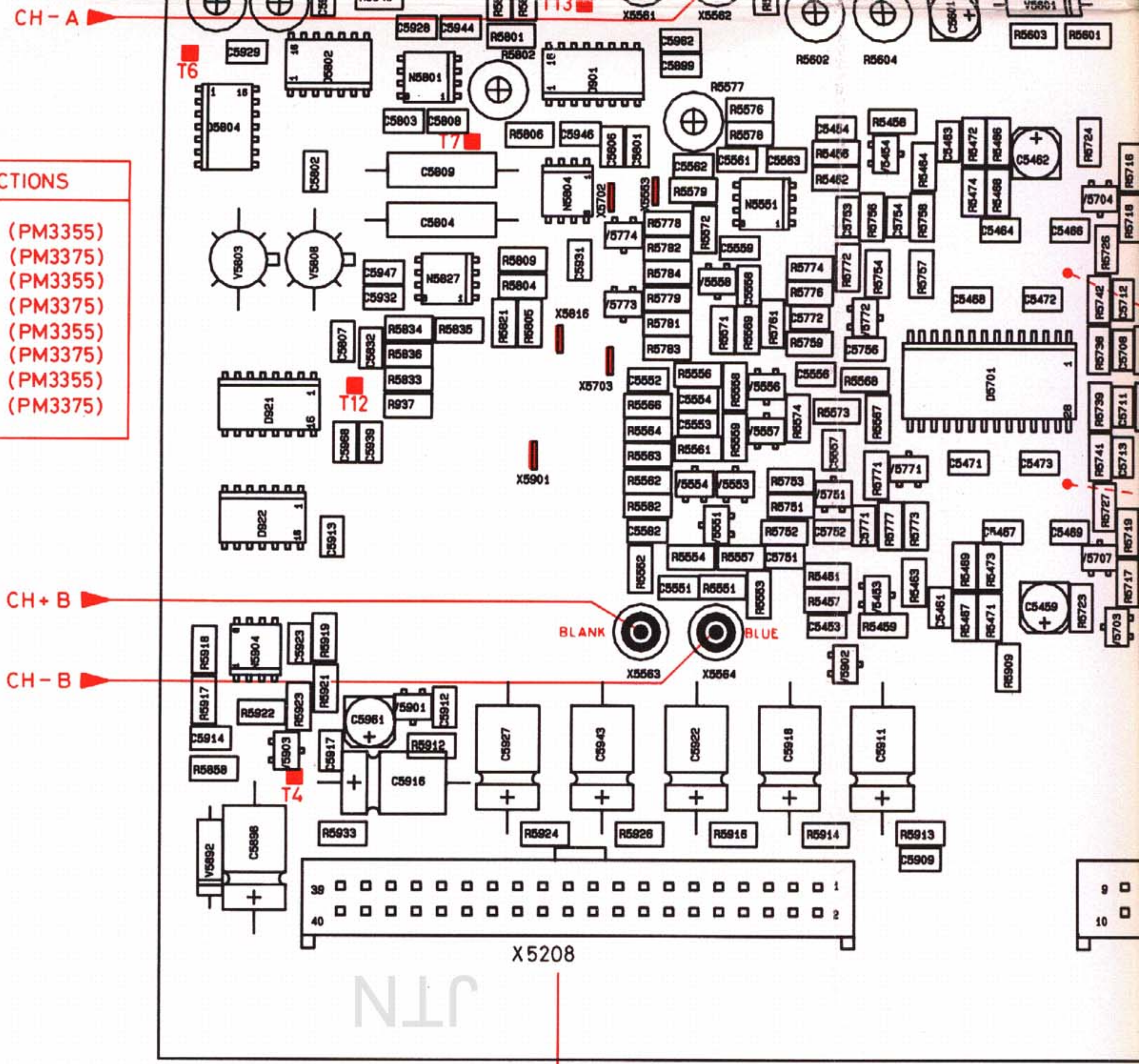
TESTPADS:

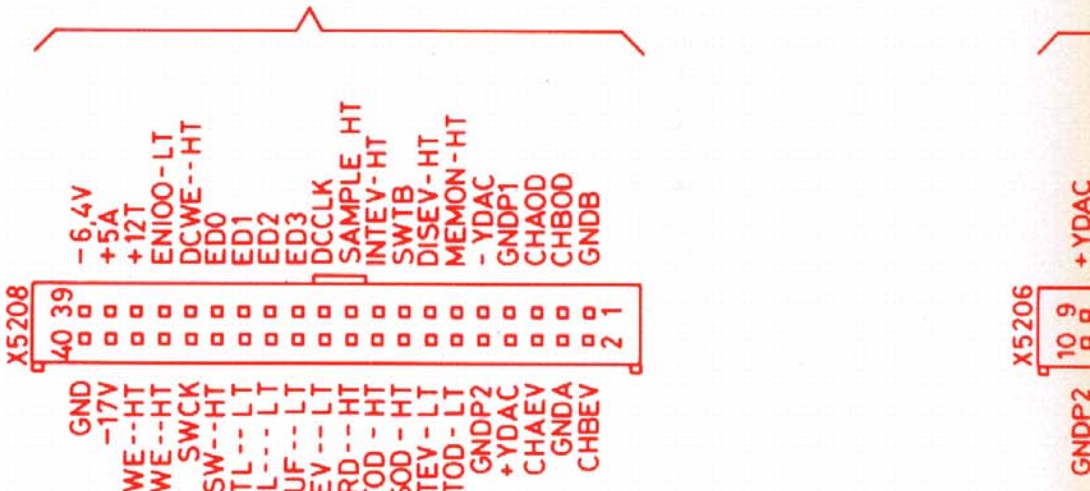
T1	100 MHz OR 125 MHz
T2	CLOCK OUT CK200250 (1 Vp-p SINE-WAVE)
T3	-4,5V
T4	+15V
T6, T7, T8, T9	Ux
T11	CHAOD OUTPUT
T12	CHAEV OUTPUT
T13	CHBOD OUTPUT
T14	CHBEV OUTPUT

SHAPES (TOP VIEW)

BC848C (1L)	BF550R (G5)
BC858B (3K)	BFR92R (P4)
BF550 (G2)	BFT92R (W4)
BFQ67 (V2)	
BFR92 (P1)	
BFS20 (G1)	
BFT92 (W1)	

50Ω CABLE CONNECTIONS		
X5561	FROM X 661	(PM3355)
	FROM X1661	(PM3375)
X5562	FROM X 662	(PM3355)
	FROM X1662	(PM3375)
X5563	FROM X 663	(PM3355)
	FROM X1663	(PM3375)
X5564	FROM X 664	(PM3355)
	FROM X1664	(PM3375)

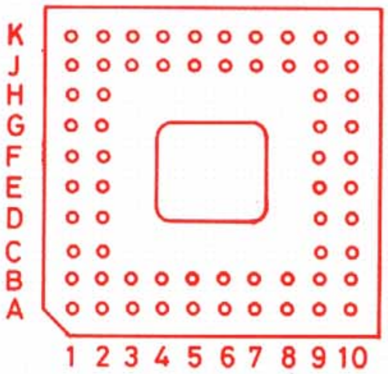


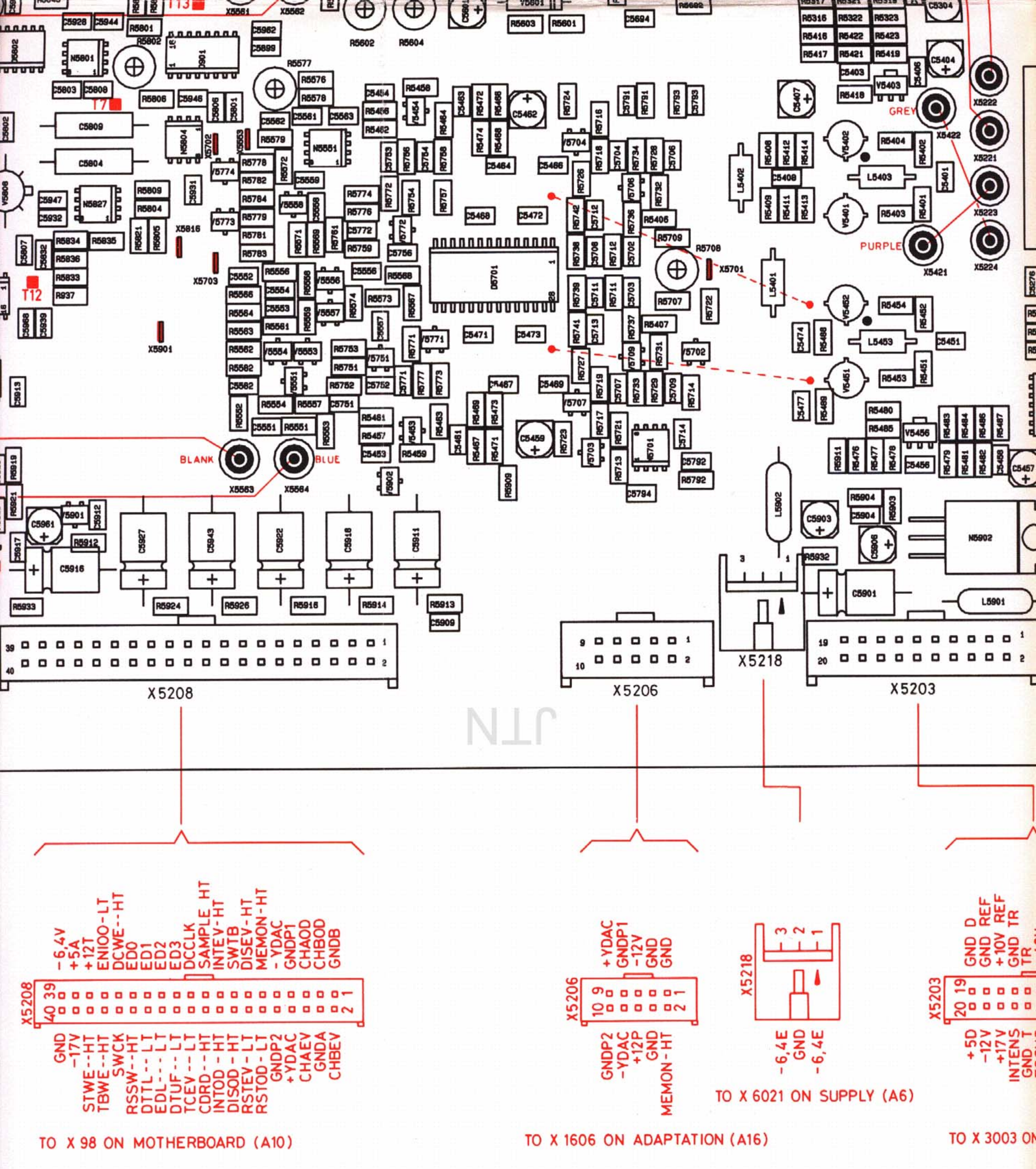


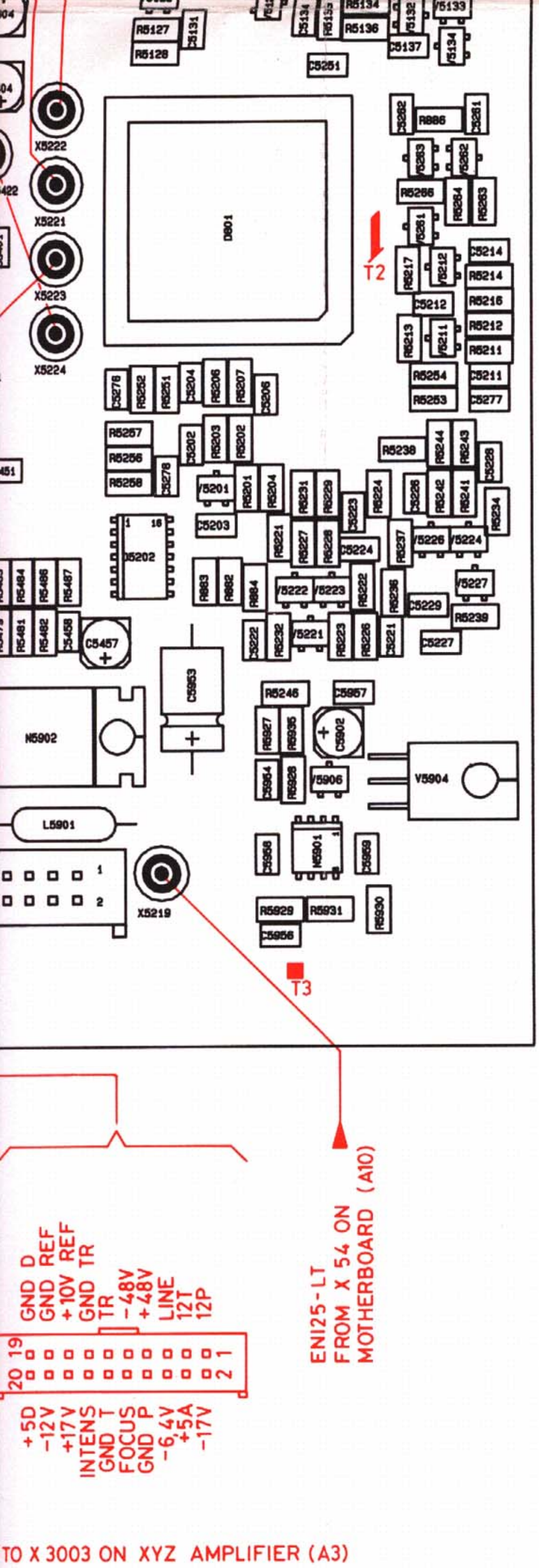
TO X 98 ON MOTHERBOARD (A10)

TO X 1606 O

SHAPE ACE D801(PIN SIDE VIEW)




X5208
X5206
X5218
X5203
BLANK
BLUE
GREY
PURPLE
-6,4V +5A +12T ENIOO-LT DCWE--HT ED0 ED1 ED2 ED3 DCCLK SAMPLE HT INTEV-HT SWTB DISEV-HT MEMON-HT -YDAC GNDP1 CHAOD CHBOD GNDB
GND -17V STWE--HT TBWE--HT SWCK RSSW--HT DTTL--LT EDL---LT DTUF--LT TCEV--LT CDRD--HT INTOD-HT DISOD-HT RSTEV-LT RSTOD-LT GNDP2 +YDAC CHAEV GNDA CHBEV
TO X 98 ON MOTHERBOARD (A10)
+YDAC GNDP1 -12V GND GND
GNDP2 -YDAC +12P GND MEMON-HT
TO X 1606 ON ADAPTATION (A16)
-6,4E GND -6,4E
TO X 6021 ON SUPPLY (A6)
GND D GND REF +10V REF GND TR
+5D -12V +17V
TO X 3003 ON



R5602 BIAS B
R5608 BAR A
R5708 BAR B

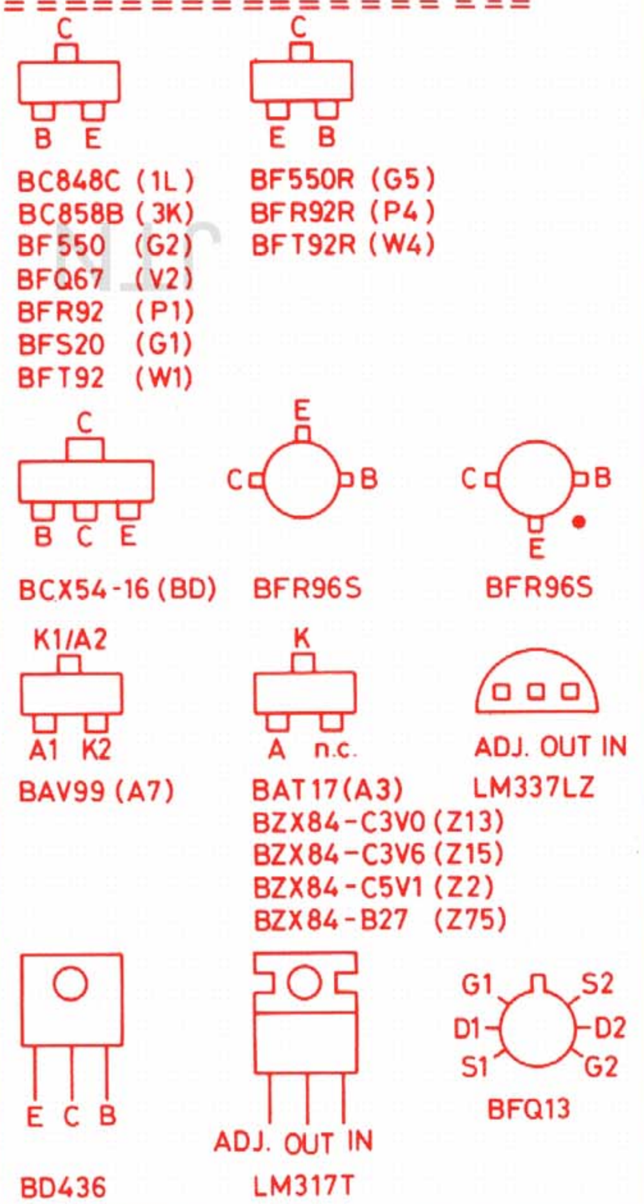
R5817 GAIN EVEN
R5802 GAIN ODD

R5828 GAIN A 200 NS
R5829 GAIN A
R5838 GAIN B 200 NS
R5839 GAIN B
R5830 OFFSET A 200 NS
R5832 OFFSET A
R5840 OFFSET B 200 NS
R5842 OFFSET B

TESTPADS :

T1	100 MHz OR 125 MHz
T2	CLOCK OUT CK200250 (1 Vp-p SINE-WAVE)
T3	-4,5V
T4	+15V
T6 T7 T8 T9	Ux
T11	CHAOD OUTPUT
T12	CHAEV OUTPUT
T13	CHBOD OUTPUT
T14	CHBEV OUTPUT

SHAPES (TOP VIEW)



MAT3794

Figure 19.25 P²CCD unit

20 PERFORMANCE TEST

20.1 GENERAL INFORMATION

WARNING: Before switching-on, ensure that the instrument has been installed in accordance with the Installation Instructions, outlined in Section 2 of the Operation Guide.

This procedure is intended to:

- Check the instrument's specification.
- Be used for incoming inspection to determine the acceptability of newly purchased instruments and/or recently recalibrated instruments.
- Check the necessity of recalibration after the specified recalibration intervals.

NOTE: The procedure does not check every facet of the instrument's calibration; rather, it is concerned primarily with those parts of the instrument which are essential to measurement accuracy and correct operation. Removing the instrument's covers is not necessary to perform this procedure. All tests are made from the outside of the instrument.

If the test is started within a short period after switching-on, bear in mind that steps may be out of specification, due to insufficient warming-up time.

Warming-up time under average conditions is 30 minutes.

The tests are made with a stable, well-focussed, low-intensity display. Unless otherwise noted, adjust the intensity and trigger-level controls as needed.

IMPORTANT NOTES

- Unless otherwise stated, set the 3 VAR controls into position CAL, the 3 POS controls and TRIG LEVEL into the centre position, HOLD OFF at MIN.

- The input voltage has to be supplied to the A-input; unless otherwise stated. Set the TIME/DIV switch to a suitable position; unless otherwise stated.

- Tolerances given are for the instrument under test and do not include test equipment error. Bear in mind that the test equipment is properly terminated.

- In some tests, channel B appears in parentheses after channel A, e.g. A(B). This indicates that the channel A test should be performed first, then the test for channel B.

20.2 RECOMMENDED TEST EQUIPMENT

Type of instrument	Required specification	Example of recommended instrument
Function generator	Freq: 1 MHz ... 10 MHz Sine-wave/square-wave Ampl: 0...20 V (pp) DC offset – 5 ... +5 V Rise-time ≤ 30 ns Duty cycle 50 %	Philips PM 5134
Constant amplitude sine-wave generator	Freq: 50 kHz ... 150 MHz. Constant pp. amplitude of 120 mV and 3 V.	Tektronix SG 503
Square-wave calibration generator	For ampl. calibration: Freq: 1 kHz Ampl: 10 mV... 50 V For rise-time measurements: Freq: 1 MHz Ampl: 10 ... 500 mV Rise-time: ≤ 1 ns	Tektronix PG 506
Time marker generator	Repetition rate: 0,5 s ... 5 ns	Tektronix TG 501
Digital multimeter	Wide voltage and current ranges.	Philips PM 2525 with AC, DC and resistance ranges. High-voltage probe. Required: 1 % accuracy, PM 9246
Variable voltage transformer (VARIAC)	Well insulated output voltage 90 ... 264 V (ac)	Philips order. number 2422 529 00005
Watt meter		NORMA type D 1150
TV pattern generator with video output		Philips PM 5518
Oscilloscope	The bandwidth must be the same or higher than the bandwidth of the instrument under test.	Philips PM 3065
50 Ω cables, 75 Ω cable, 50 Ω terminations, 75 Ω termination, 10:1 attenuator, T-piece, power splitter	Tektronix and Philips BNC types for fast rise-time square-wave, high freq. sine-wave and other applications.	TEK 012-0482-00 TEK 012-0074-00 TEK 011-0049-01 TEK 011-0055-01 TEK 011-0059-02 PHI PM 9067 PHI PM 9584/02
Trimming tools		Philips 800NTX (ord. kit number 4822 310 50095) or Bernstein nr. 1-250

20.3 TEST PROCEDURE

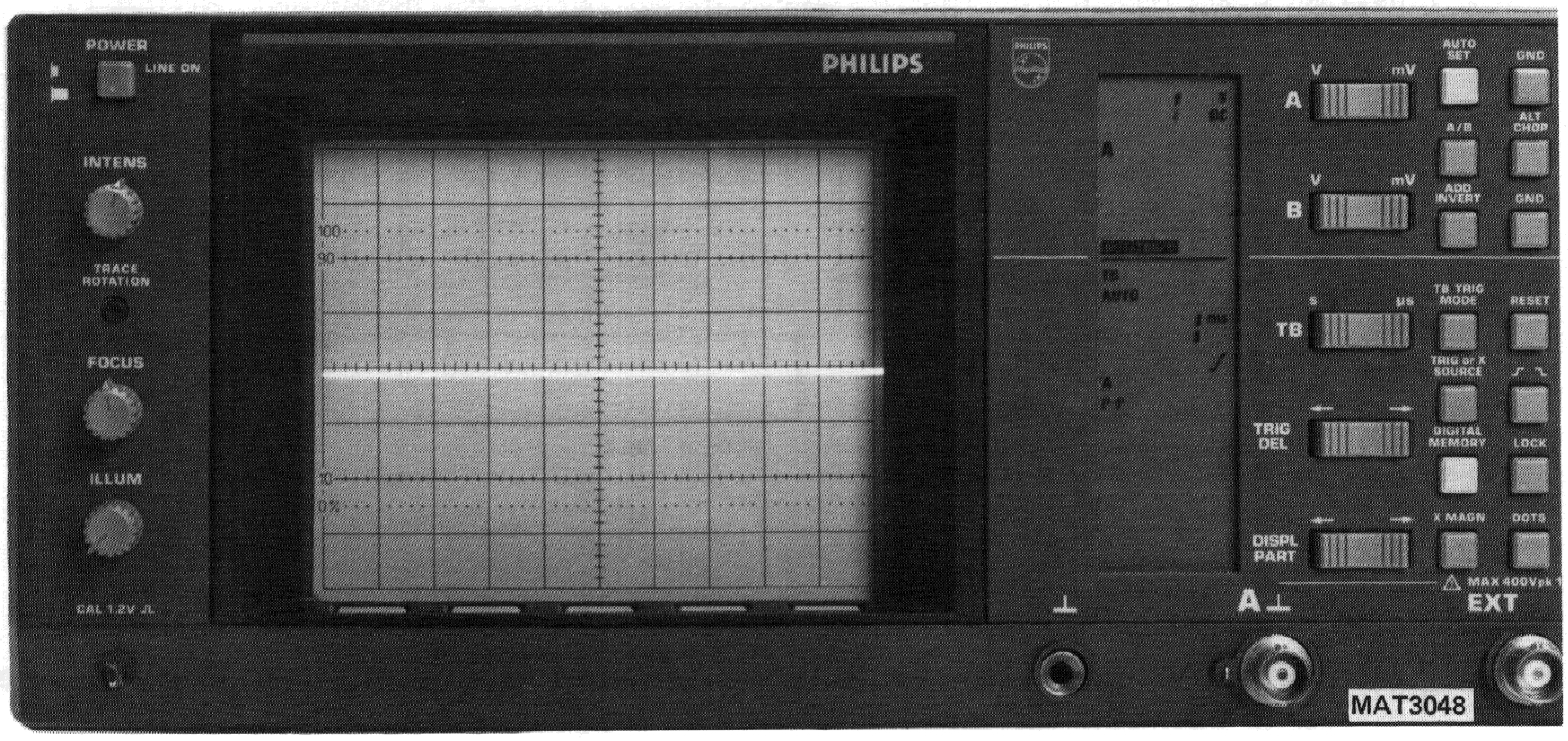


Figure 20.1 SOFTSTART condition.

20.3.1 Preliminary settings

test equipment:

None

settings/procedure and requirements:

1 – Switch-on the oscilloscope under test.
2 – Check that all LCD segments on the frontpanel of the oscilloscope are on for approximately 1 second.
3 – Press pushbuttons MENU and AUTO SET in sequence.
4 – Check that the front controls of the oscilloscope are set in the softstart condition as indicated in figure 20.1.
5 – At the start of every test, the AUTO SET button must be pressed (after the input signal is applied).
6 – Press the AUTO SET button to leave the softstart condition.

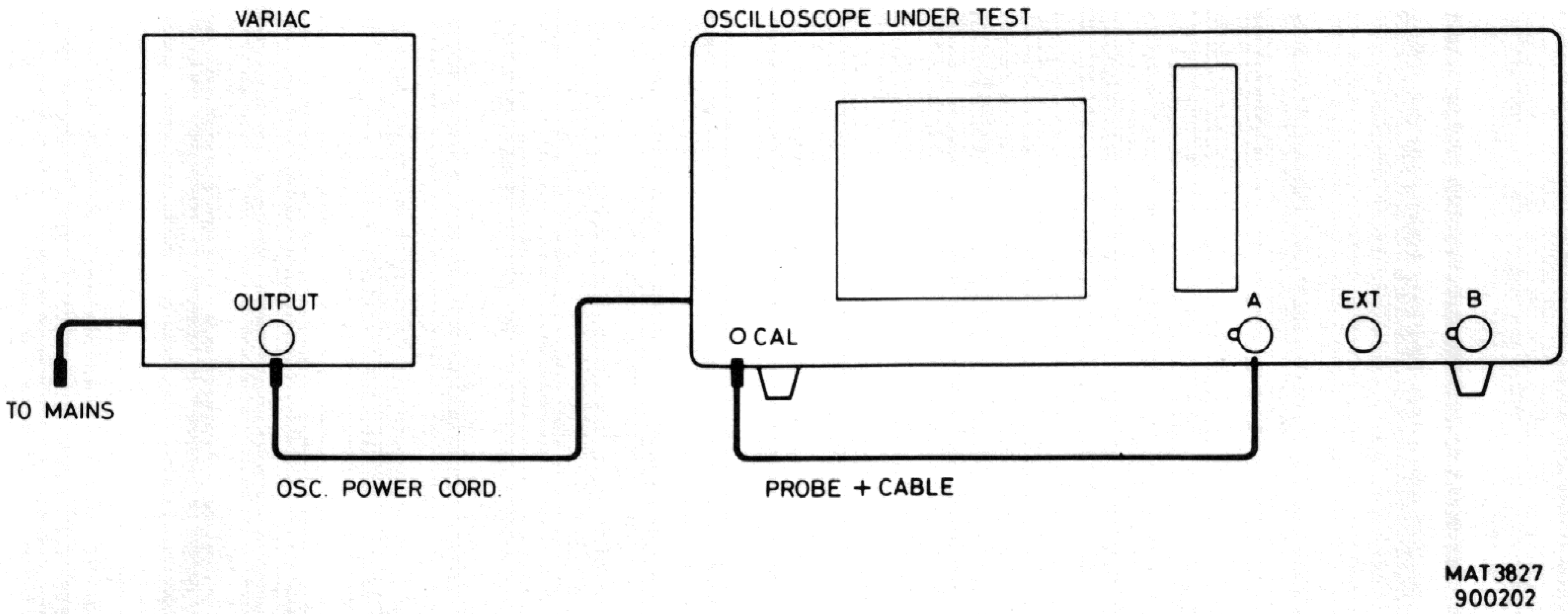
20.3.2 Power supply

In this test the correct working of the power supply at all possible line voltages is tested.

test equipment:

Variable voltage transformer (VARIAC)

test set-up:



settings/procedure:

1 – Adjust the input line voltage to the oscilloscope (output from VARIAC) to a desired value between 100 and 240 V (r.m.s.), frequency 50...400 Hz.
2 – Press POWER ON button of the oscilloscope.
3 – Apply the CAL signal provided on the front panel of the oscilloscope to input A, e.g. by means of a probe.
4 – Press the AUTO SET button.

requirements:

1 – Oscilloscope must start at any input voltage between 100 and 240 V.
2 – The instrument's performance does not change over the indicated voltage range; the displayed CAL signal is distortion-free and has equal intensity.

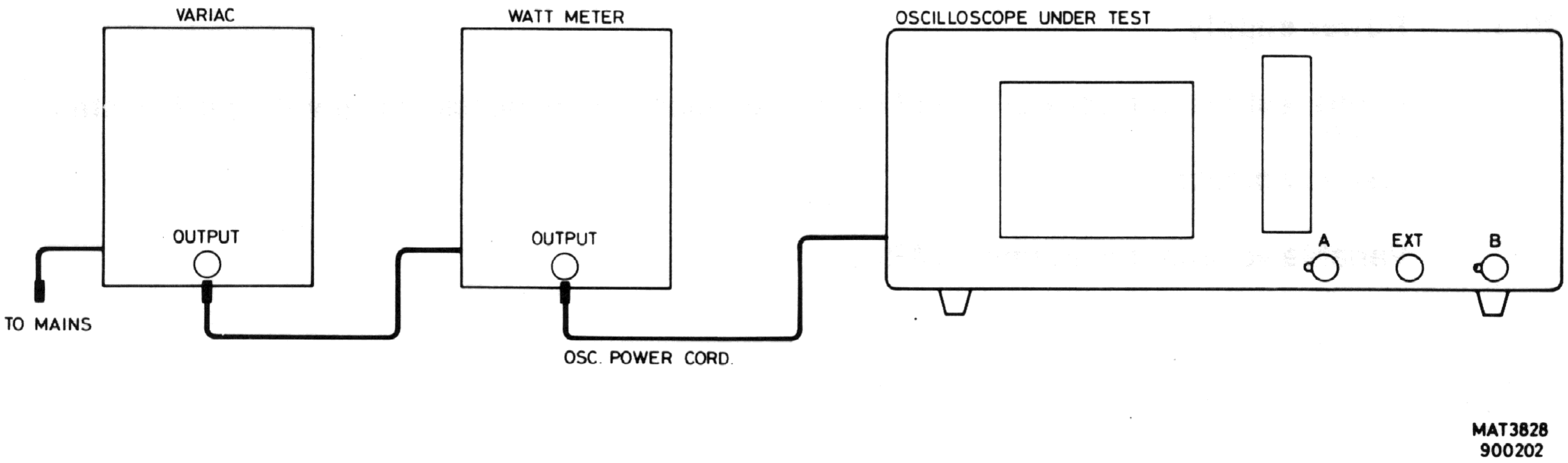
20.3.3 Power consumption

This test checks the power consumption of the oscilloscope.

test equipment:

- Variable voltage transformer (VARIAC)
- Watt meter

test set-up:



settings/procedure:

1 – Adjust the input voltage (output from VARIAC) to the oscilloscope to the nominal line voltage.
2 – Press POWER ON button of the oscilloscope.

requirements:

Power consumption is maximum :
- 70 W for PM3350A/PM3352A
- 80 W for PM3355/PM3357

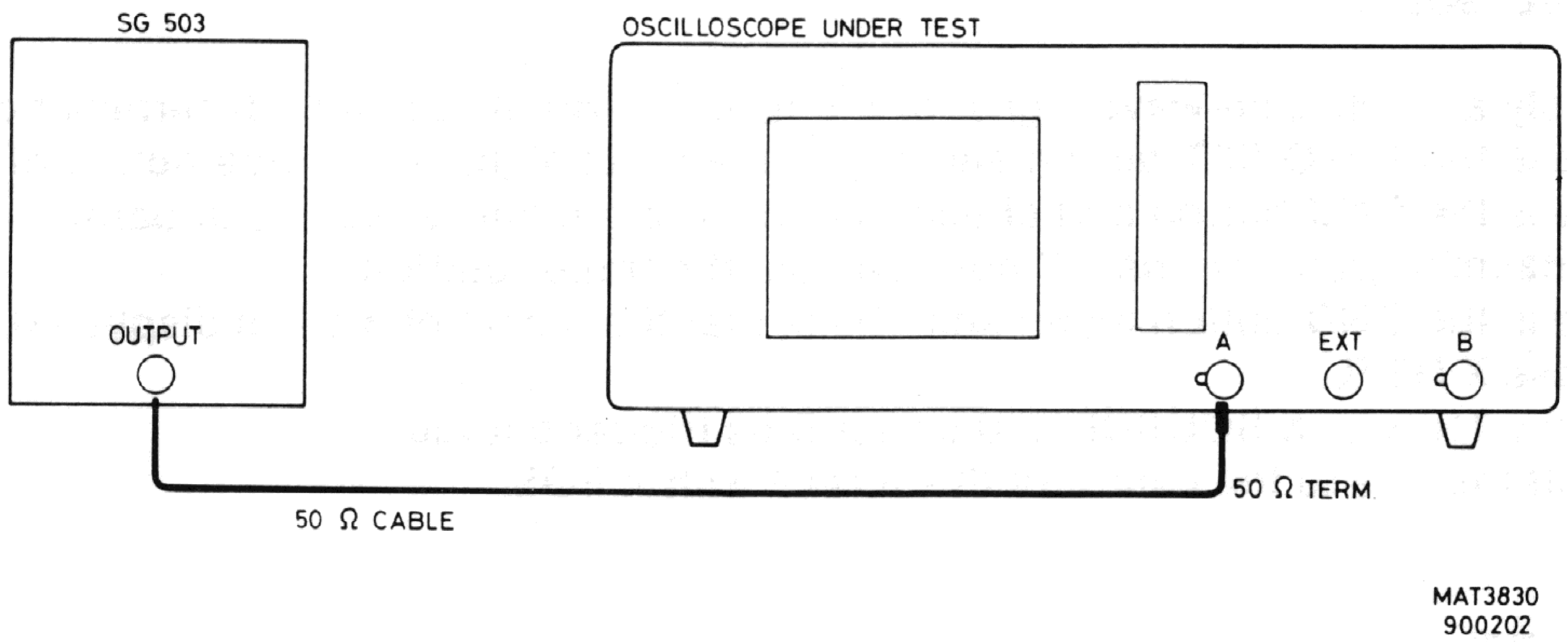
20.3.4 Auto set

This test checks the correct working of the auto set function.

test equipment:

Constant amplitude sine-wave generator (SG 503)

test set-up:



settings/procedure:

1 – Set channels A and B to 20 mV/div; the other settings are not relevant.
2 – Apply a 50 MHz sine-wave signal of 60 mV (pp) to input A; use a 50 Ω termination.
3 – Press the AUTO SET button.

requirements:

Check that the display is stable and well-triggered.

Repeat settings/procedure for channel B.

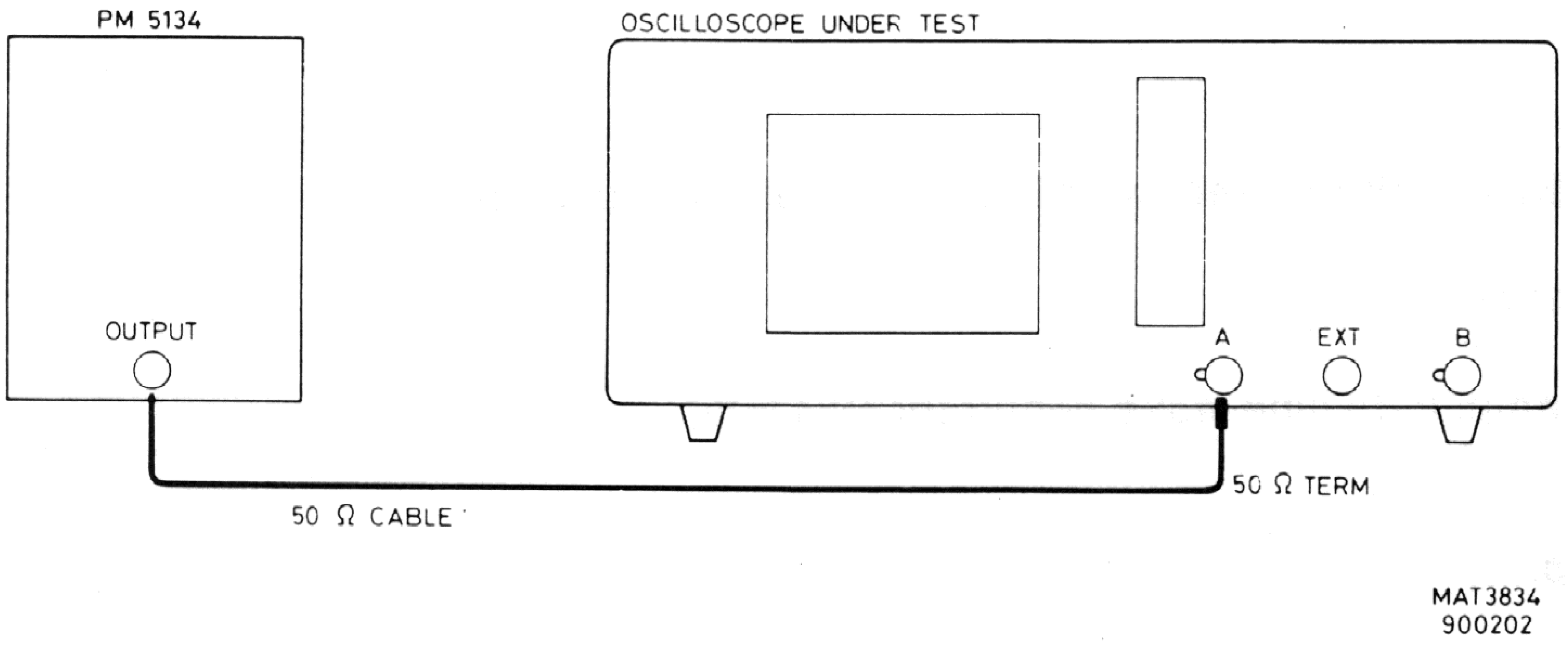
20.3.5 Orthogonality

In this test the angle between the horizontal and vertical deflection plates, the so called orthogonality, is checked.

test equipment:

LF sine-wave generator (function generator, PM 5134)

test set-up:



settings/procedure:

1 – Apply a 50 Hz sine-wave signal of 8 V (pp) to input A; use a 50 Ω termination.
2 – Press the AUTO SET button and adjust the input signal to a trace-height of 8 div.
3 – Press the GND button and check that the straight line is exactly in parallel with the horizontal graticule lines. If not, readjust the trace rotation.
4 – Press the GND button again and check that the signal of 8 div is displayed.
5 – Press X DEFL.
6 – Press TRIG or X SOURCE and select B as trigger source.
7 – Shift the line to the centre of the screen with X POS.

requirements:

1 – Check that the vertical line is in parallel with the vertical graticule line in the centre of the screen.
2 – Verify that the angle with respect to the horizontal graticule lines is 90° ± 1° as indicated in figure 4.2.

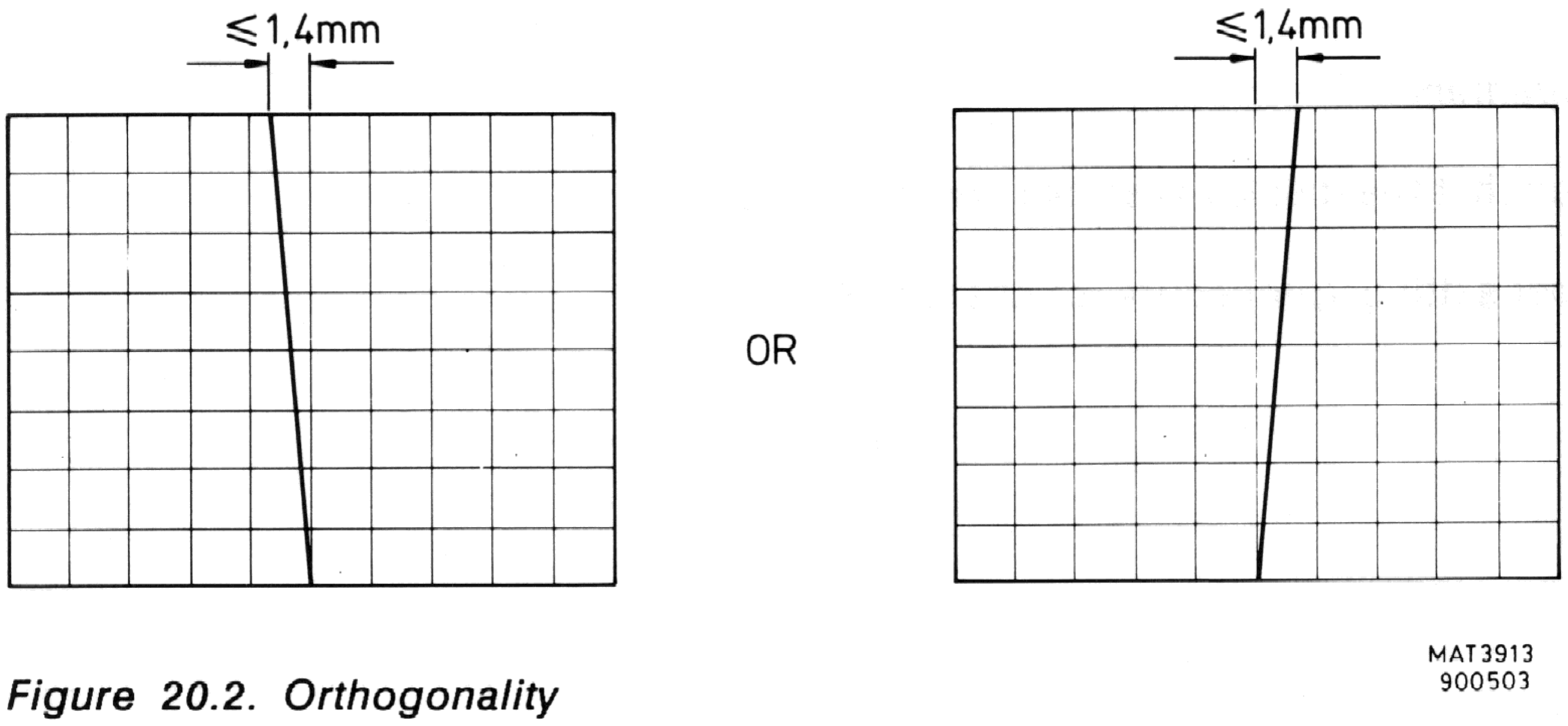


Figure 20.2. Orthogonality

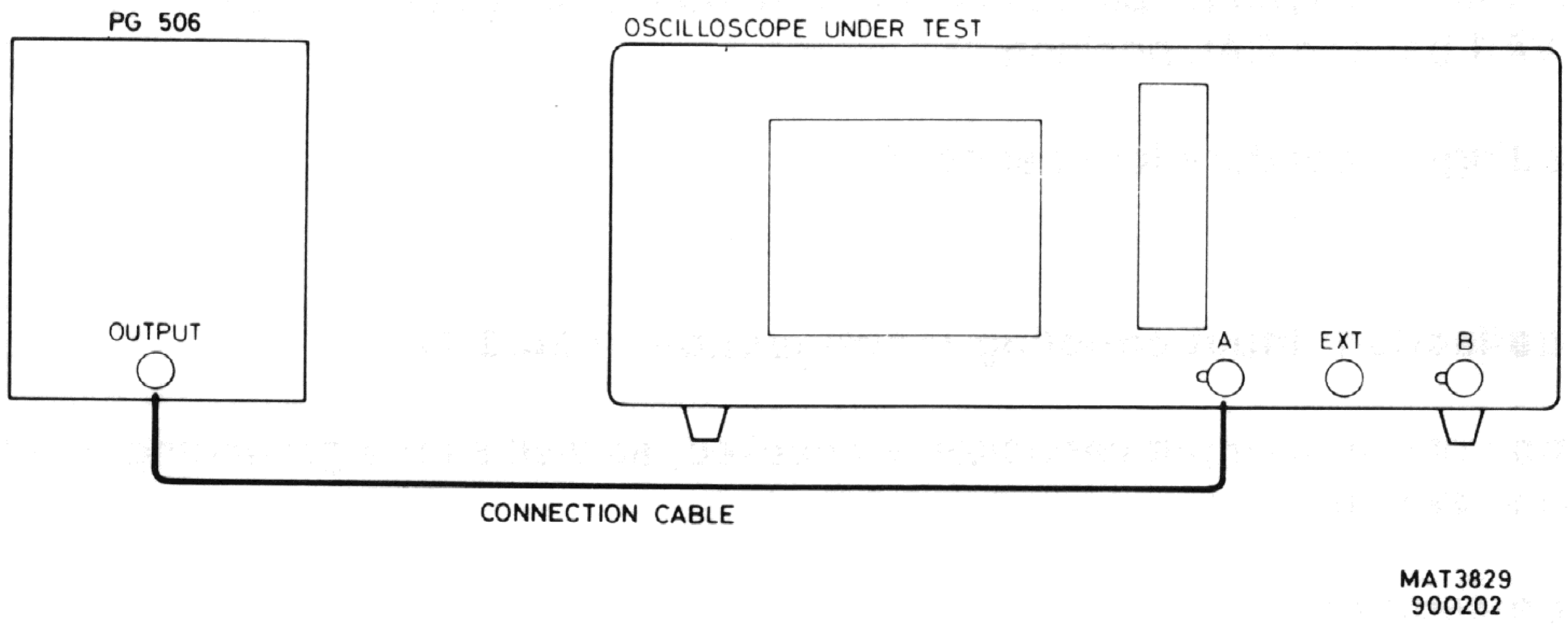
20.3.6 Vertical deflection; deflection coefficients

The vertical deflection coefficients of both channels A and B are checked by means of a calibrated signal.

test equipment:

Square-wave calibration generator (PG 506)

test set-up:



settings/procedure:

1 – Apply a 1 kHz square-wave signal of 10 mV to input A.
Generator in position STD AMPL.
2 – Press the AUTO SET button.
3 – Set channel A to 2 mV/div and to DC.
4 – Change the input voltage and the setting of channel A according to the table below and check that the amplitude of the signal agrees with this table.

requirements:

Input voltage (pp)	A(B) setting	Requirements
10 mV	2 mV	4,85...5,15 div
20 mV	5 mV	3,88...4,12 div
50 mV	10 mV	4,85...5,15 div
0,1 V	20 mV	4,85...5,15 div
0,2 V	50 mV	3,88...4,12 div
0,5 V	0,1 V	4,85...5,15 div
1 V	0,2 V	4,85...5,15 div
2 V	0,5 V	3,88...4,12 div
5 V	1 V	4,85...5,15 div
10 V	2 V	4,85...5,15 div
20 V	5 V	3,88...4,12 div
50 V	10 V	4,85...5,15 div

Repeat settings/procedure for channel B.

20.3.7 Vertical deflection; variable gain control range (continuation of 20.3.6)

In this test the range of the vertical variable gain control is checked.

settings/procedure:

1 – Apply a square-wave signal of 5 V to input A and press AUTO SET.
2 – Set channel A to 1 V/div and to DC.
3 – Turn the VAR control of channel A fully counter clockwise.

requirements:

Verify that the displayed amplitude is not more than 2 div (ratio 1 : 2,5) and turn VAR back to CAL position.

Repeat settings/procedure for channel B.

20.3.8 Vertical deflection; input coupling (continuation of 20.3.7)

The function of the AC input capacitor is checked, as well as the grounding function of the coupling switch.

settings/procedure:

Turn the VAR control knob fully clockwise.

requirements:

Check for both channel A and B.

1 – Press the GND button and check that the signal disappears and that a straight line is displayed.
2 – Press the GND button again, then the AC/DC button and check that the signal shifts upwards when DC is pressed.

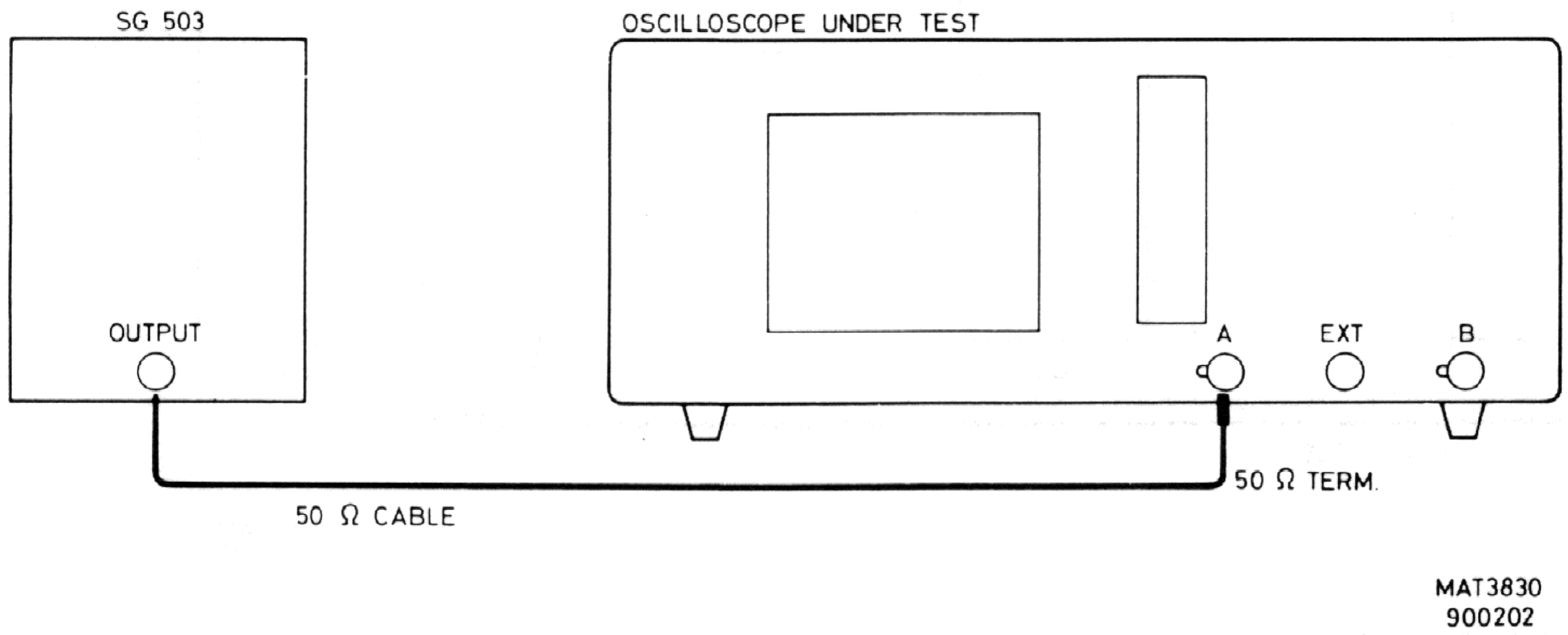
20.3.9 Vertical deflection; frequency response

This test is performed to verify the vertical bandwidth.

test equipment:

Constant amplitude sine-wave generator (SG 503)

test set-up:



settings/procedure:

1 – Apply a 50 kHz sine-wave signal of 120 mV (pp) to input A and press the AUTO SET button; use a 50 Ω termination.
2 – Set channel A to 20 mV/div and VAR to CAL.
3 – Adjust the input signal to a trace-height of exactly 6 div.
4 – Increase the frequency up to 60 MHz (slowly) and verify that the vertical deflection is 4,2 div or more over the complete bandwidth range.
5 – Reduce the amplitude of the input signal to 12 mV and the frequency to 50 kHz.
6 – Set channel A to 2 mV/div and adjust the input signal to a trace-height of exactly 6 div.
7 – Increase the frequency up to 35 MHz (slowly) and check that the vertical deflection is 4,2 div or more over the complete bandwidth range.

requirements:

The vertical deflection must be 4,2 div or more.

Repeat settings/procedure for channel B.

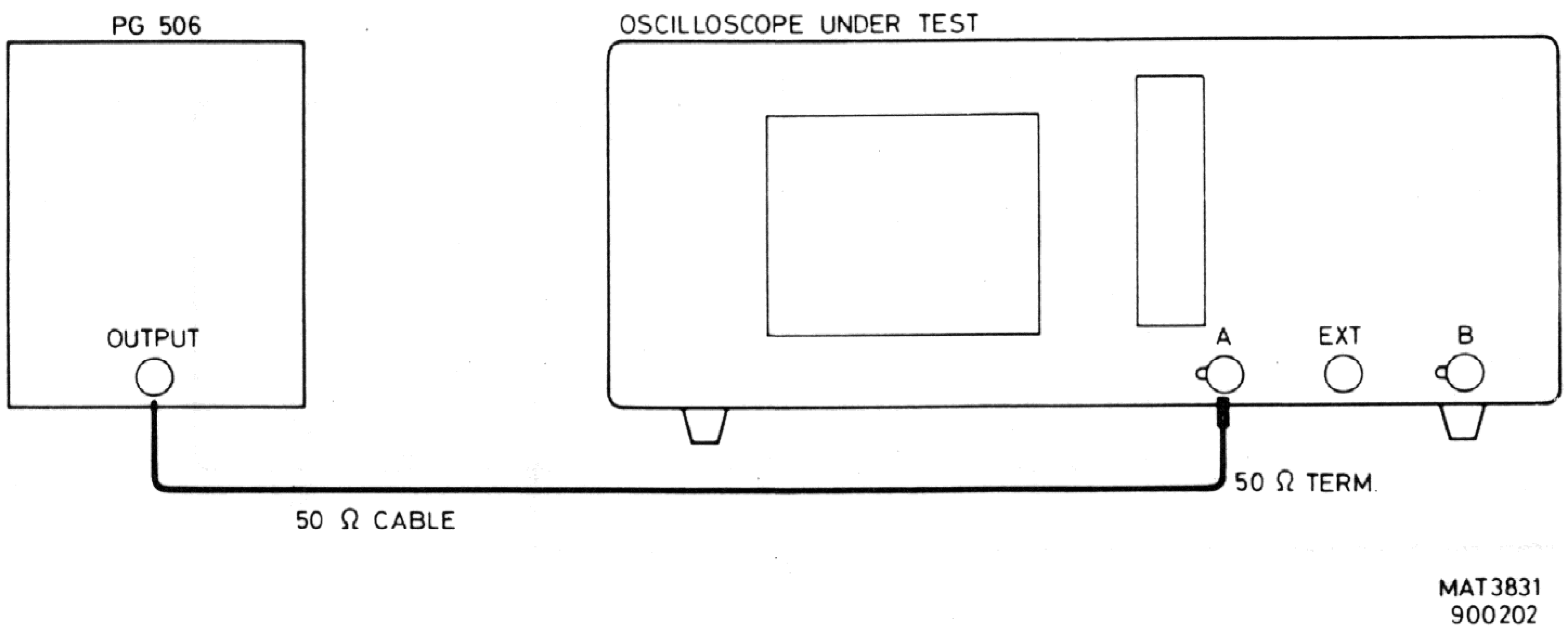
20.3.10 Vertical deflection; rise-time

By means of a fast rise-time pulse the rise-time of the oscilloscope is checked.

test equipment:

Fast rise-time square-wave generator (PG 506)

test set-up:



settings/procedure:

1 – Apply a fast rise-time pulse, repetition frequency 1 MHz, to input A; use a 50 Ω termination. Generator in position FAST RISE.
2 – Set A to 100 mV/div.
3 – Press X MAGN.
4 – Set TB to 5 ns/div.
5 – Position the rising edge of the signal to the horizontal centre of the screen, by means of the X POS control.
6 – Adjust the trace-height exactly between the dotted lines 0 % and 100 % (5 div).

requirements:

Important: tr (measured) $= \sqrt{\text{tr (input signal)}^2 + \text{tr (oscilloscope)}^2}$

1 – Check the rise-time, measured between the 10 % and 90 % lines (4 div).
2 – The rise-time measured must be 5,8 ns (1,16 div) or less.

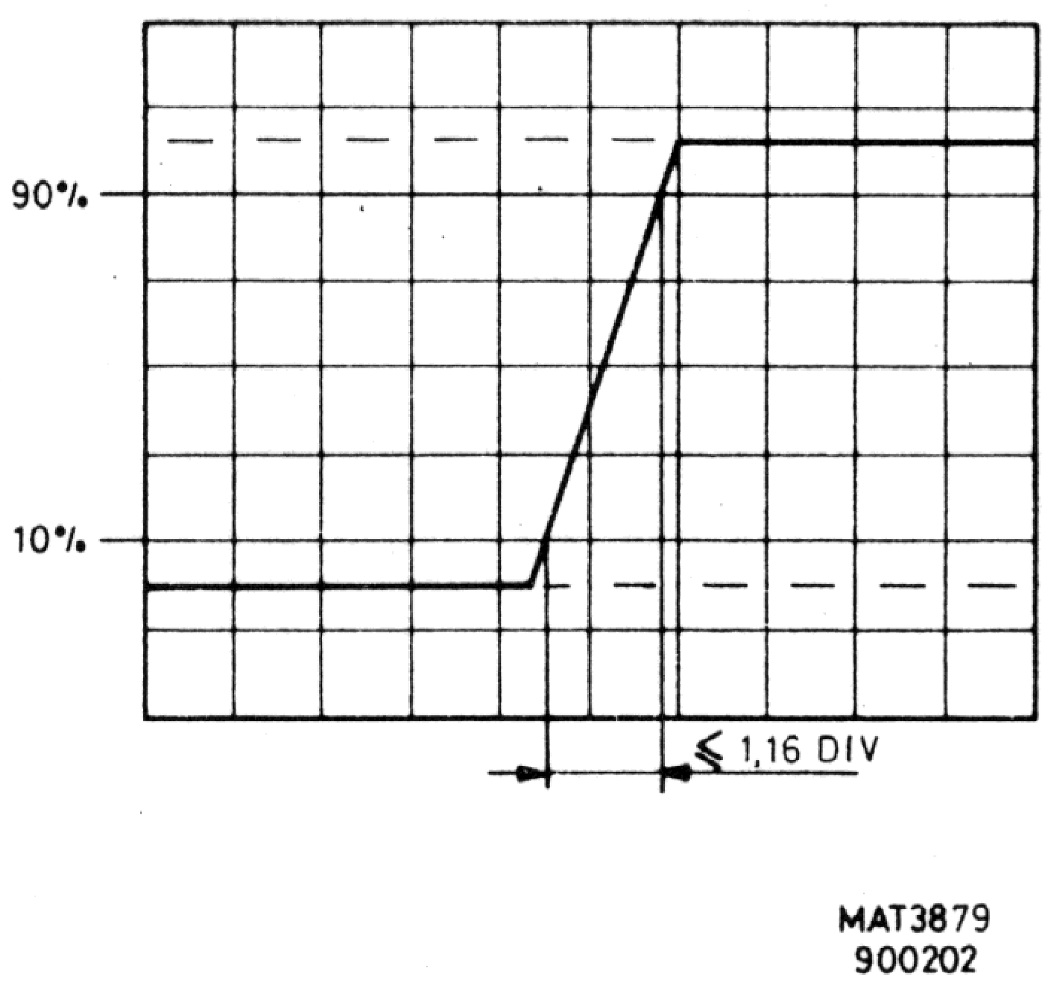


Figure 20.3 Rise-time

20.3.11 Vertical deflection; noise

The noise, caused by the instrument's amplifiers, may not exceed a certain value. This value is checked by the following procedure.

test equipment:

None

settings/procedure:

1 – Press A/B: channel A and B on.
2 – Set channel A and B to 20 mV/div.
3 – Press ALT/CHOP for CHOP mode.
4 – Press GND of both channels, for grounded input coupling.

requirements:

Ensure that the traces are not thicker than 0,1 div (0,5 subdiv).

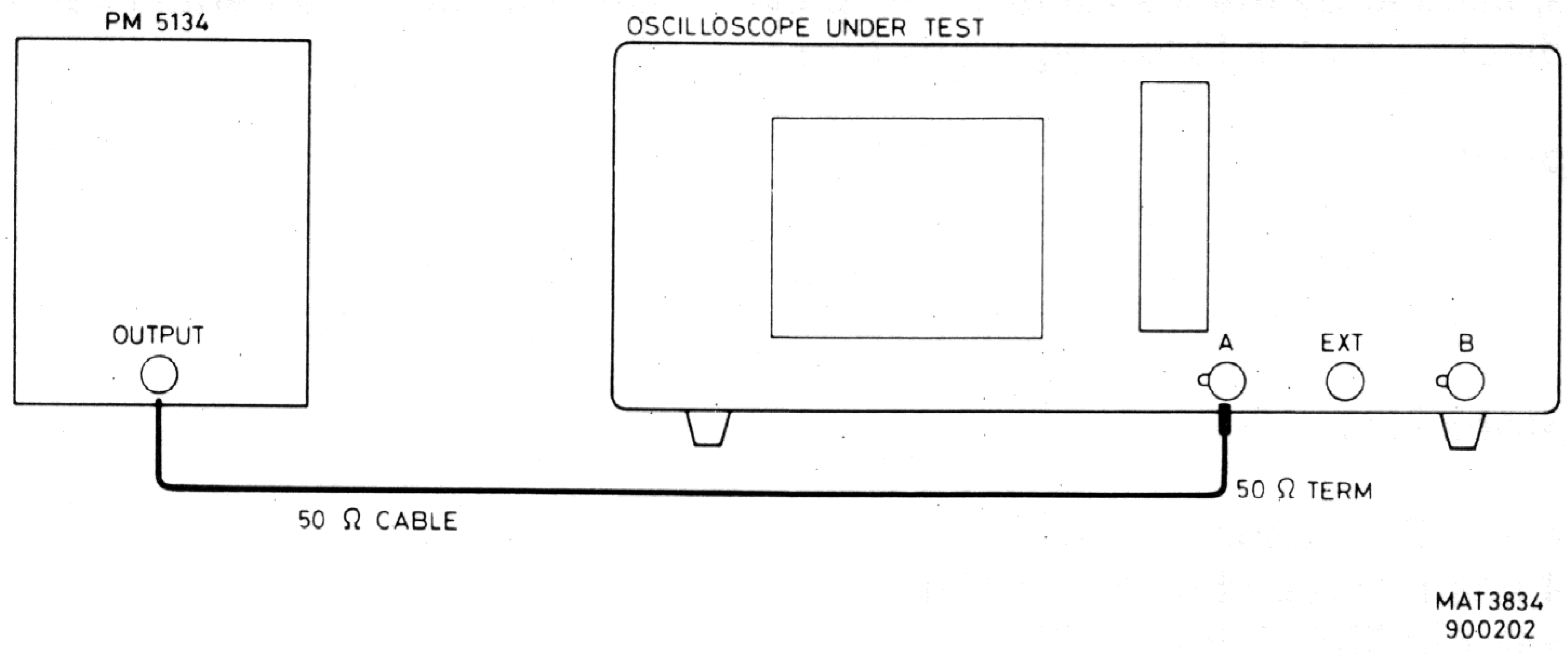
20.3.12 Vertical deflection; dynamic range at 10 MHz

A certain overdrive of the oscilloscope must be allowed. In practice, a signal of 24 divisions must be displayed distortion-free at low frequencies.

test equipment:

Constant amplitude sine-wave generator (SG 503)

test set-up:



settings/procedure:

1 – Apply a 10 MHz sine-wave signal of 2,4 V (pp) to input A; use a 50 Ω termination.
2 – Press the AUTO SET button and set A to 0,1 V/div.
3 – Shift the sine-wave vertically over the screen by means of the Y POS control.

requirements:

Verify that top and bottom of the sine-wave signal of 24 divisions can be displayed distortion-free.

Repeat settings/procedure for channel B.

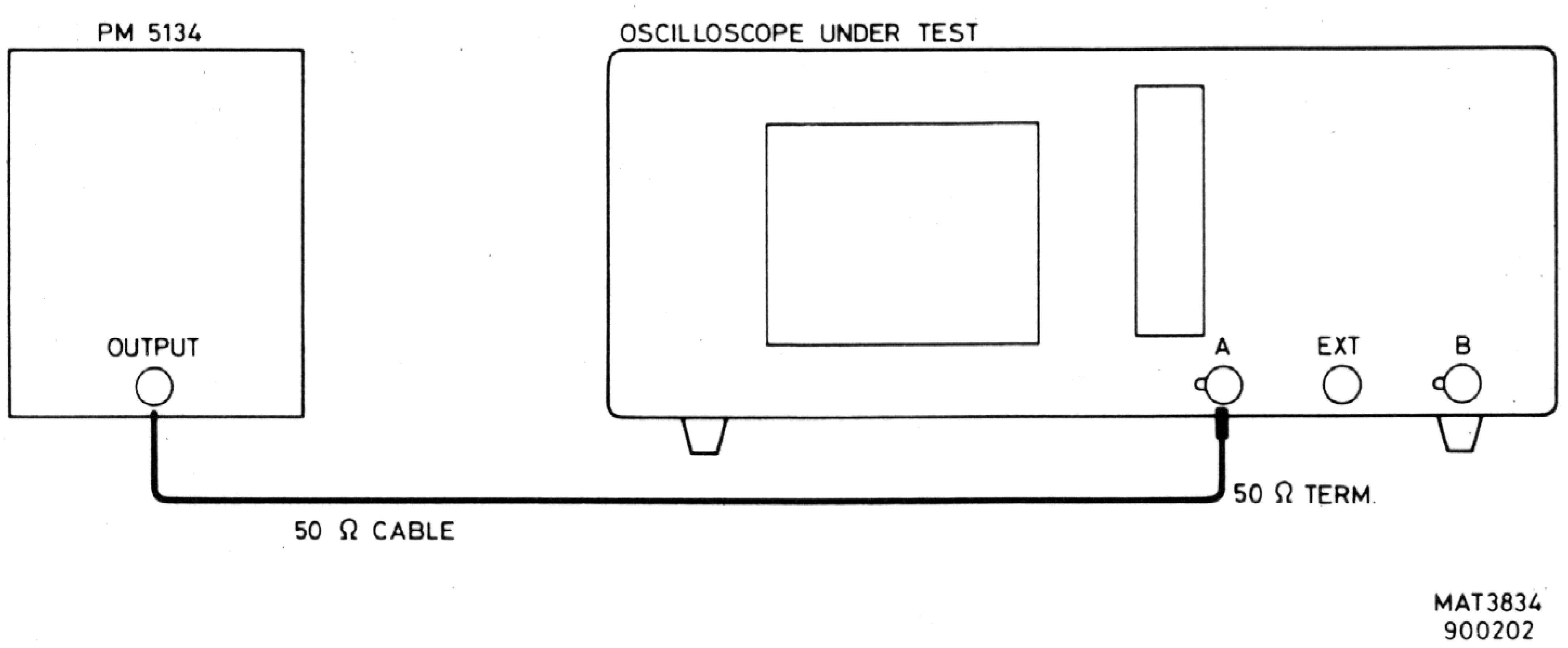
20.3.13 Vertical deflection; position range

The range of the vertical shift is checked by means of a signal of 16 divisions.

test equipment:

LF sine-wave generator (function generator, PM 5134)

test set-up:



settings/procedure:

1 – Apply a 1 kHz sine-wave signal of 8 V (pp) to input A; use a 50 Ω termination.
2 – Press the AUTO SET button and set A to 0,5 V/div.

requirements:

Rotate the Y POS control of channel A fully clockwise and counter clockwise and check that the top and bottom of the signal can be positioned on the vertical centre of the screen.

Repeat settings/procedure for channel B.

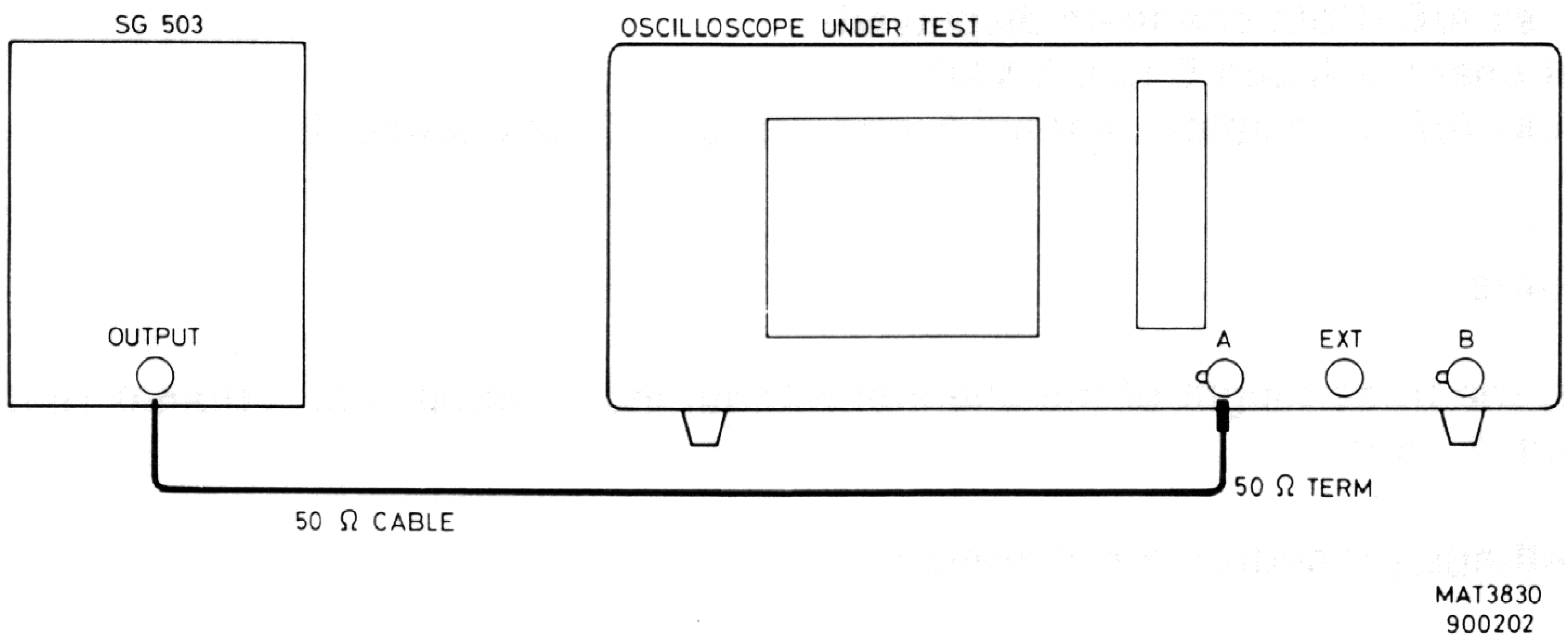
20.3.14 Vertical deflection; cross talk between A and B at 10 MHz

Both channels A and B influence each other. A certain amount of interference is allowed, this is checked here.

test equipment:

Constant amplitude sine-wave generator (SG 503)

test set-up:



settings/procedure:

1 – Apply a 10 MHz sine-wave signal of 4 V (pp) to input A; use a 50 Ω termination.
2 – Press the AUTO SET button.
3 – Press A/B (both channels displayed).
4 – Set channel A and B to 0,5 V/div.
5 – Press A/B, to display channel B and press GND of channel B.

requirements:

Verify that the trace-height of the channel without input signal is less than 0,08 div, (better than 1 : 100).

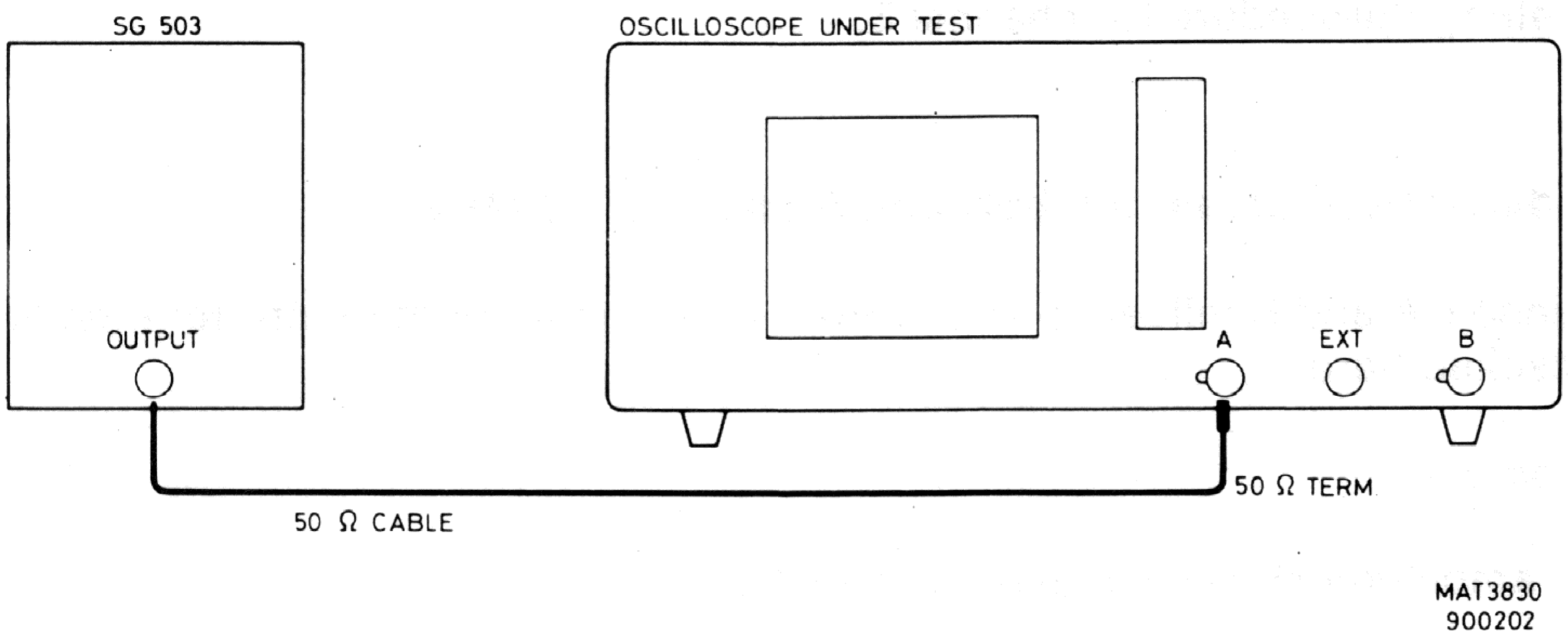
20.3.15 Vertical deflection; cross talk between A and B at 60 MHz

At higher frequencies the interference between the two channels is more. Now, the test is carried out at a high frequency.

test equipment:

Constant amplitude sine-wave generator (SG 503)

test set-up:



settings/procedure:

1 – Apply a 60 MHz sine-wave signal of 4 V (pp) to input A; use a 50 Ω termination.
2 – Press the AUTO SET button.
3 – Press A/B (both channels displayed).
4 – Set channel A and B to 0,5 V/div.
5 – Press A/B, to display channel B and press GND of channel B.

requirements:

Verify that the trace-height of the channel without input signal is less than 0,16 div, (better than 1 : 50).

Repeat settings/procedure for channel B.

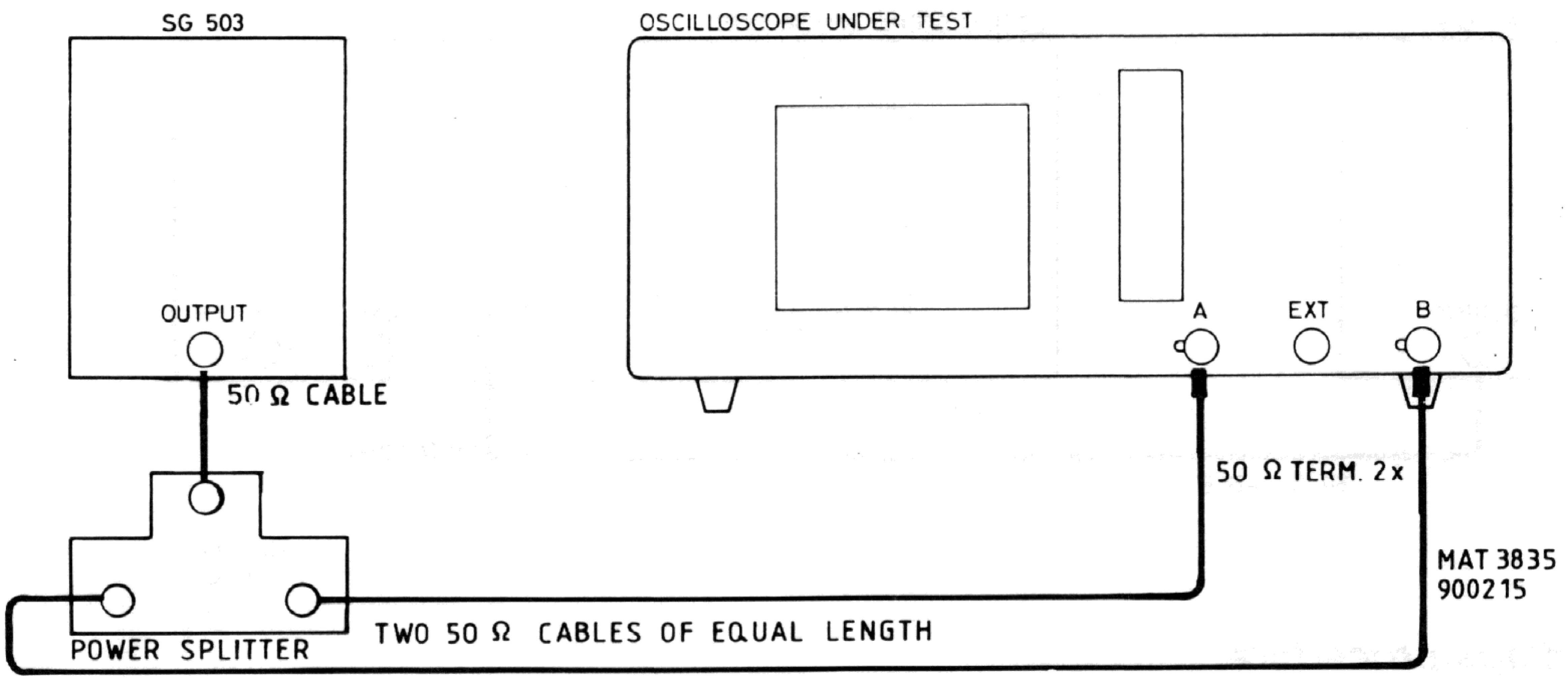
20.3.16 Vertical deflection; common mode rejection ratio

The common mode rejection ratio (CMRR) indicates the susceptibility to common mode signals, this is checked in this test.

test equipment:

- HF constant amplitude sine-wave generator (SG 503)
- Power splitter

test set-up:



settings/procedure:

1 – Apply a 1 MHz sine-wave signal of 4 V (pp) to inputs A and B. Use a power splitter and two cables of equal length to A and B. Use 50 Ω terminations.
2 – Press the AUTO SET button.
3 – Set A and B to 0,5 V/div and adjust the input voltage to exactly 4 div.
4 – Set A and B to 0,2 V/div and input coupling to DC.
5 – Press ADD/INVERT 3 times (ADD and INVERT on).
6 – Adjust the VAR controls of A and B for minimum trace-height of the straight line.
7 – Press A/B 2 times, only the straight line is visible now.
8 – Readjust one of the VAR controls for minimum trace-height.

requirements:

Check that the trace-height of the A – B signal is less than 0,1 div.

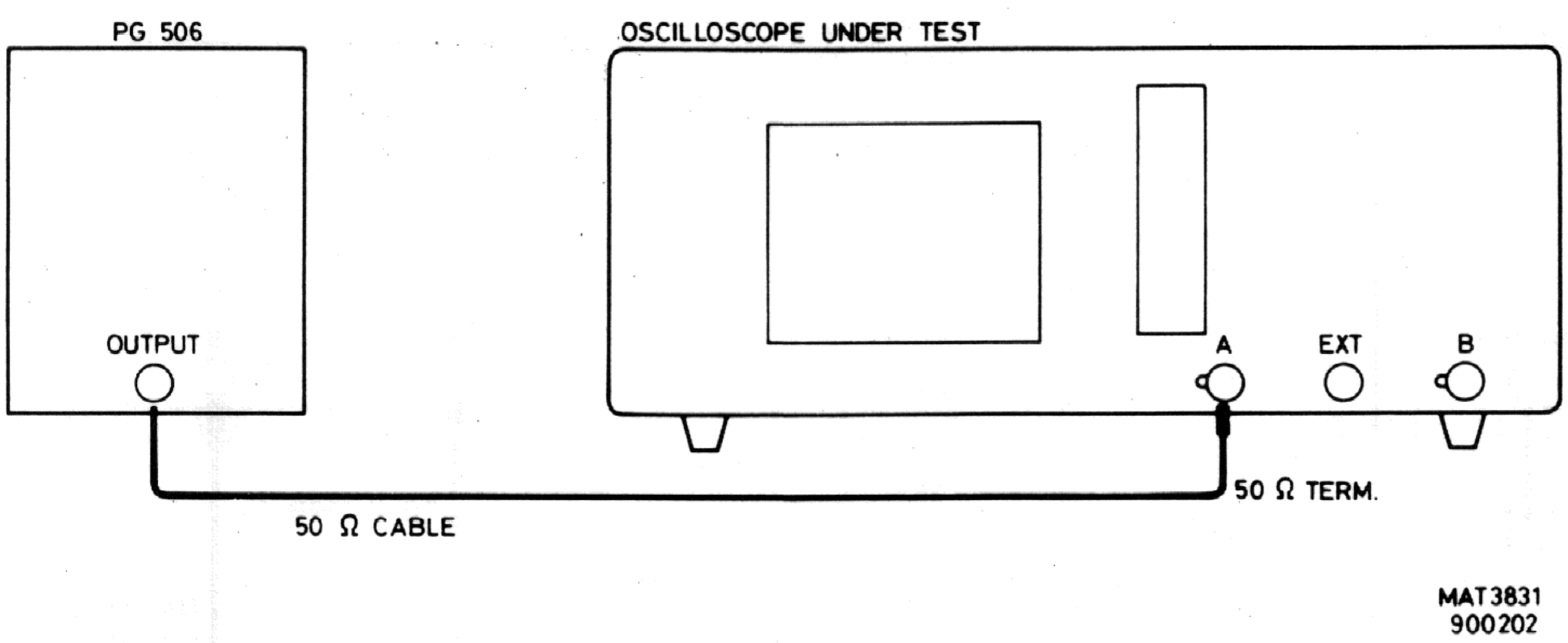
20.3.17 Vertical deflection; visual signal delay

It must be possible to observe the rising edge of a pulse. Therefore, a certain signal delay is introduced in the instrument. This delay is checked in this test.

test equipment:

Square-wave calibration generator (PG 506)

test set-up:



settings/procedure:

1 – Apply a fast rise-time (≤ 1 ns) signal of 0,5 V, frequency 1 MHz, to input A; use a 50 Ω termination. Generator in position FAST RISE.
2 – Press the AUTO SET button and set A to 0,1 V/div.
3 – Set TB to 50 ns/div.
4 – Press X MAGN and turn X POS to display the rising edge.
5 – Turn INTENSITY fully clockwise.
6 – Set trigger coupling to DC.
7 – Adjust TRIG LEVEL for maximum visual signal delay.

requirements:

Verify that the visual signal delay is at least 15 ns (3 div).

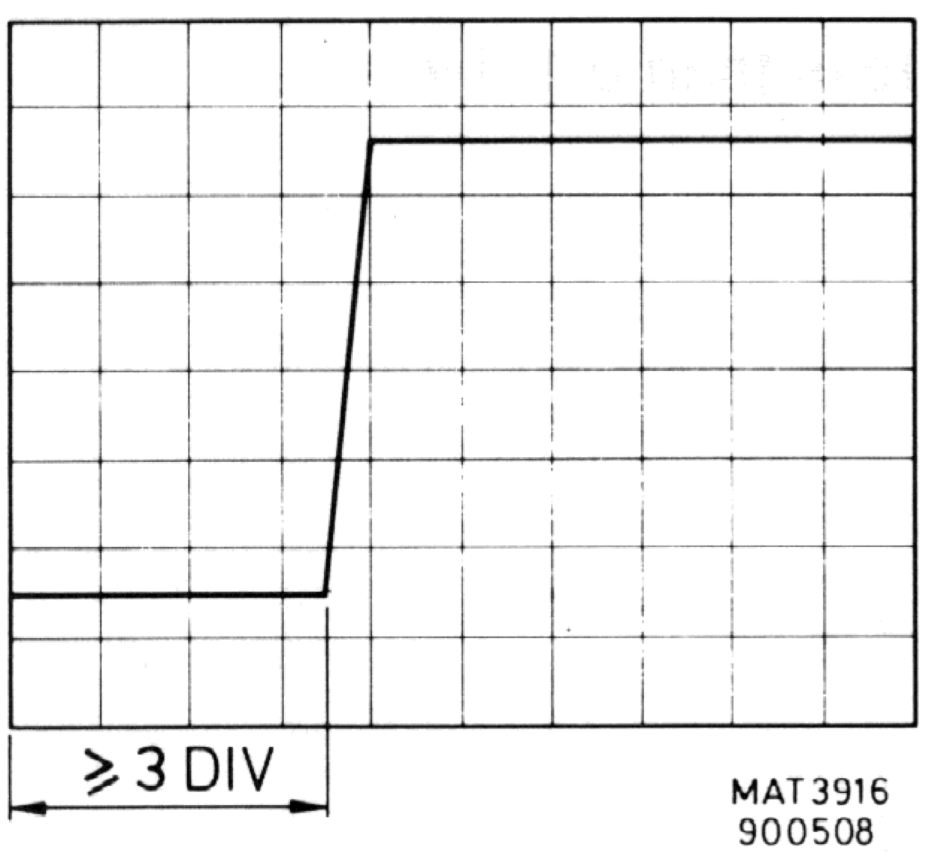


Figure 20.4 Visual signal delay

20.3.18 Vertical deflection; base line jump

Several adjustments of balance, offset and jump, are checked here.

test equipment:

None

settings/procedure
and requirements:

This test must be done in the service menu OFFS-A.
To enter this menu proceed as follows:
Press MENU and keep it pressed, then press AUTO SET,
the LCD will show an asterisk (*).

Attenuator balance:

1 – Select OFFS-A of CRT function controls.
2 – Check LCD display: "3.0" flashing.
3 – The attenuator is switched between the 1-2-5 positions.
4 – Verify that both spots do not jump more than 0,2 div (1 subdiv).
If necessary, turn Y POS to show 2 spots.

VAR balance:

1 – Press mV of channel A UP-DOWN control.
2 – Check LCD display: "3.1" flashing.
3 – Rotate VAR control of channel A.
4 – Verify that spot A does not shift more than 0,2 div (1 subdiv).
5 – Reset VAR control back to CAL.
6 – Rotate VAR control of channel B.
7 – Verify that spot B does not shift more than 0,2 div (1 subdiv).
8 – Reset VAR control back to CAL.

x1/x10 attenuator offset:

1 – Press mV of channel A UP-DOWN control
2 – Check LCD display: "3.2" flashing.
3 – Verify that both spots do not jump more than 0,3 div (1,5 subdiv).

NORMAL-INVERT jump:

1 – Press mV of channel A UP-DOWN control 4 times.
2 – Check LCD display: "3.6" flashing.
3 – Verify that the spot does not jump more than 0,2 div (1 subdiv).
4 – Press AUTO SET 2 times to leave the service menu.

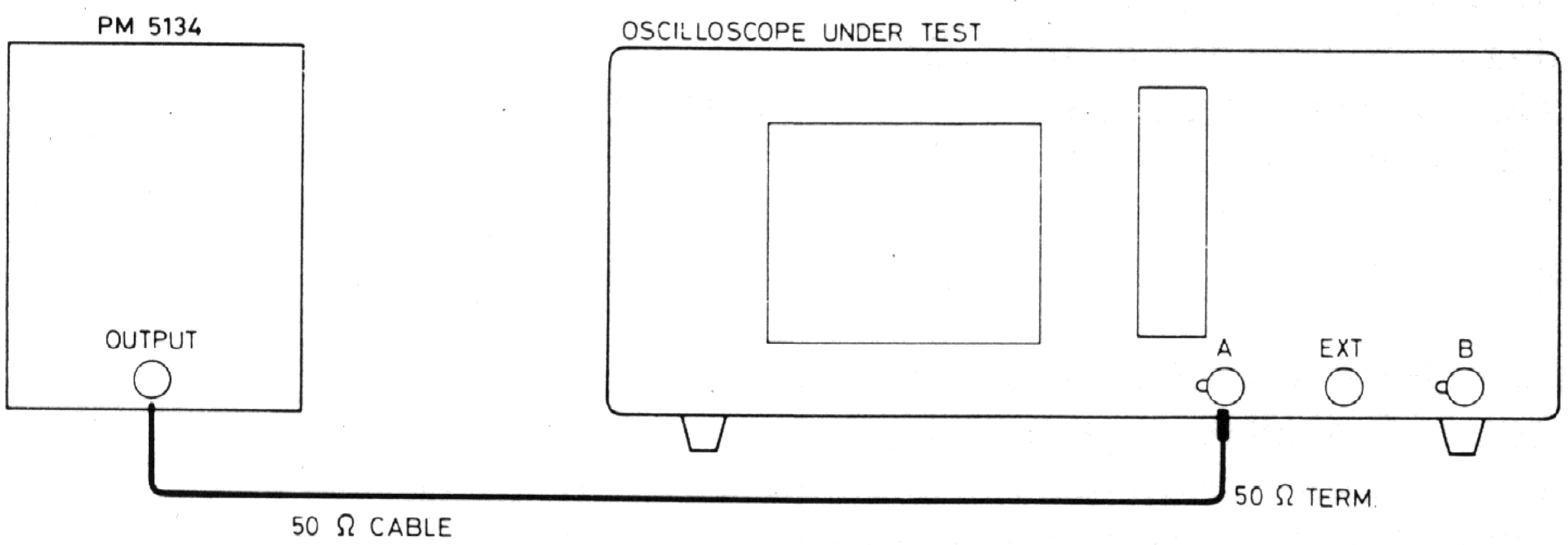
20.3.19 Horizontal deflection; X deflection

The correct working of the X-Y mode is tested.

test equipment:

LF sine-wave generator (function generator, PM 5134)

test set-up:



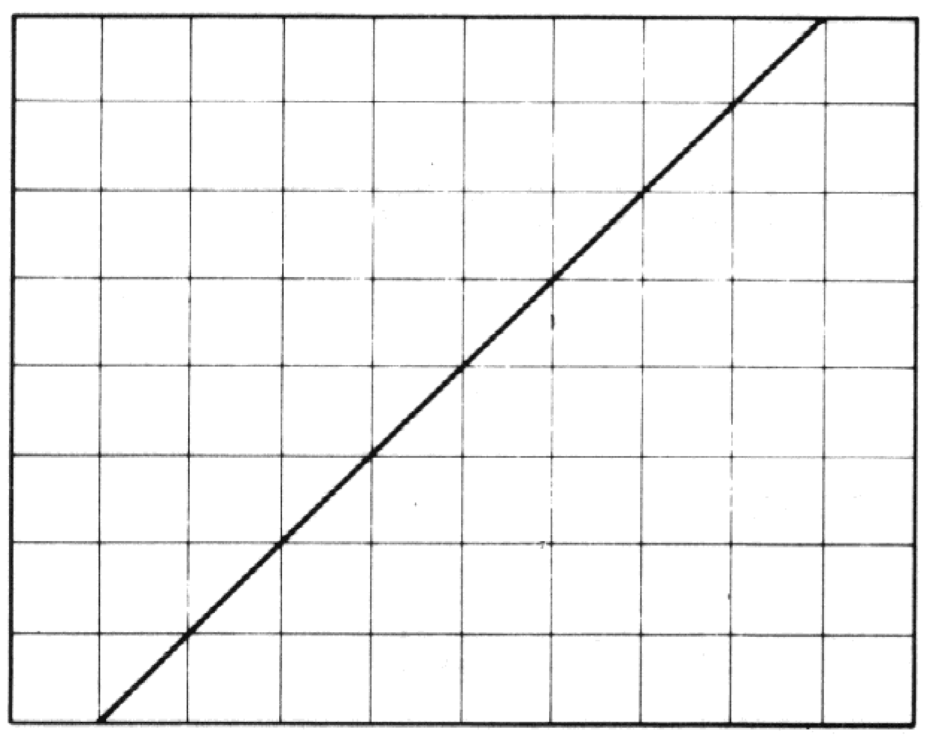
MAT3834
900202

settings/procedure:

1 – Apply a 2 kHz sine-wave signal of 800 mV (pp) to input A; use a 50 Ω termination.
2 – Press the AUTO SET button and set A to 0,1 V/div.
3 – Adjust the input signal to a trace-height of 8 div.
4 – Press X DEFL and check that only the X DEFL is on.

requirements:

Verify that a line with an angle of 45° is displayed.



MAT3837
900503

Figure 20.5 X deflection

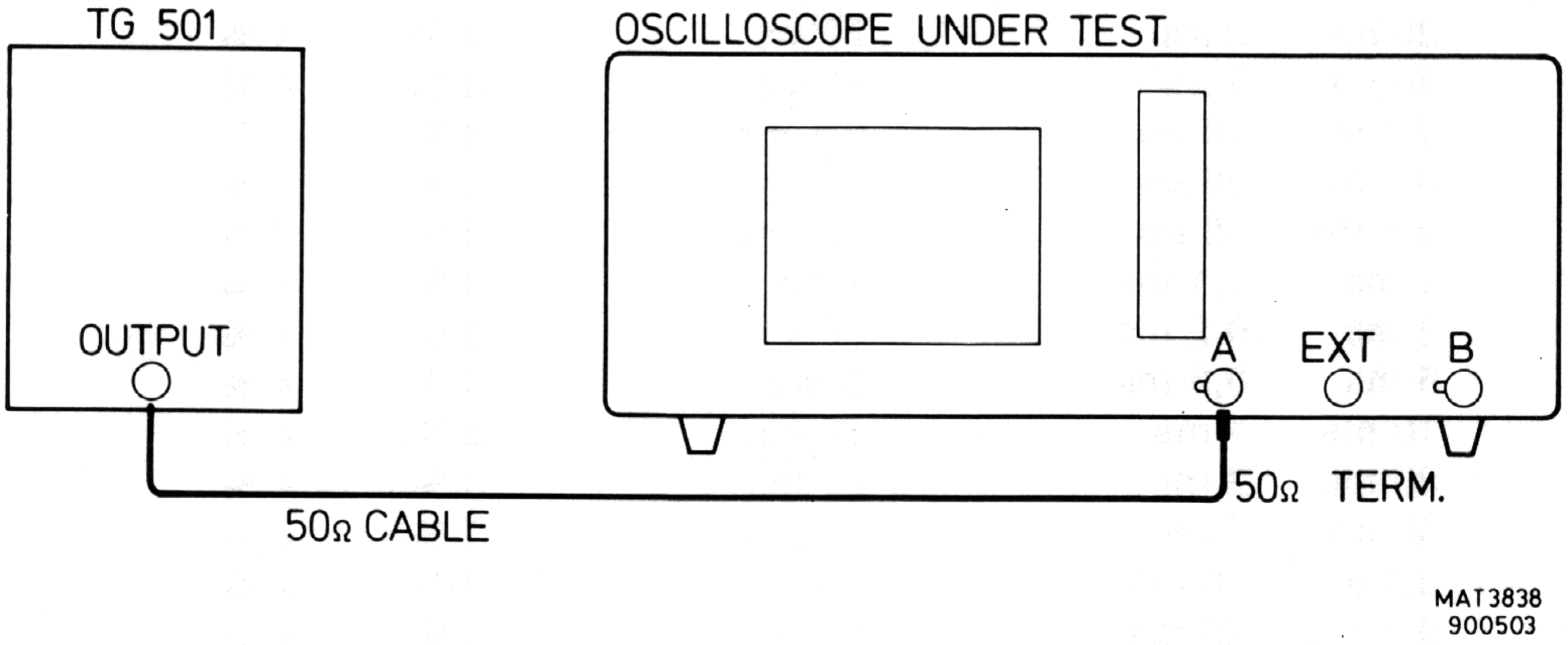
20.3.20 Horizontal deflection; time-base deflection coefficients

The deflection coefficients of the time-base generator are verified by means of a calibration signal.

test equipment:

Time marker generator (TG 501)

test set-up:



settings/procedure:

1 – Apply a 50 ns time marker signal to input A; use a 50 Ω termination.
2 – Press the AUTO SET button.
3 – Verify the deflection coefficients in TB x1 and TB x10 according to the table in requirements. Make use of the deflection error facility of the TG 501.

NOTE: *- Error limits must be measured between the 2nd and 10th graticule line; there are 11 graticule lines.*
- In TB x10 measured on the central 10 div of the expanded TB of 100 div.

requirements:

Marker pulse at: TB x1	TB x10	TB setting	Max. error at: TB x1	TB x10
50 ns	5 ns	50 ns	3 %	4 %
0,1 μs	10 ns	0,1 μs	3 %	4 %
0,2 μs	20 ns	0,2 μs	3 %	4 %
0,5 μs	50 ns	0,5 μs	3 %	4 %
1 μs	0,1 μs	1 μs	3 %	4 %
2 μs	0,2 μs	2 μs	3 %	4 %
5 μs	0,5 μs	5 μs	3 %	4 %
10 μs	1 μs	10 μs	3 %	4 %
20 μs	2 μs	20 μs	3 %	4 %
50 μs	5 μs	50 μs	3 %	4 %
0,1 ms	10 μs	0,1 ms	3 %	4 %
0,2 ms	20 μs	0,2 ms	3 %	4 %
0,5 ms	50 μs	0,5 ms	3 %	4 %
1 ms	0,1 ms	1 ms	3 %	4 %
2 ms	0,2 ms	2ms	3 %	4 %
5 ms	0,5 ms	5 ms	3 %	4 %
10 ms	1 ms	10 ms	3 %	4 %
20 ms	2 ms	20 ms	3 %	4 %
50 ms	5 ms	50 ms	3 %	4 %
0,1 s	10 ms	0,1 s	3 %	4 %
0,2 s	20 ms	0,2 s	3 %	4 %
0,5 s	50 ms	0,5 s	3 %	4 %

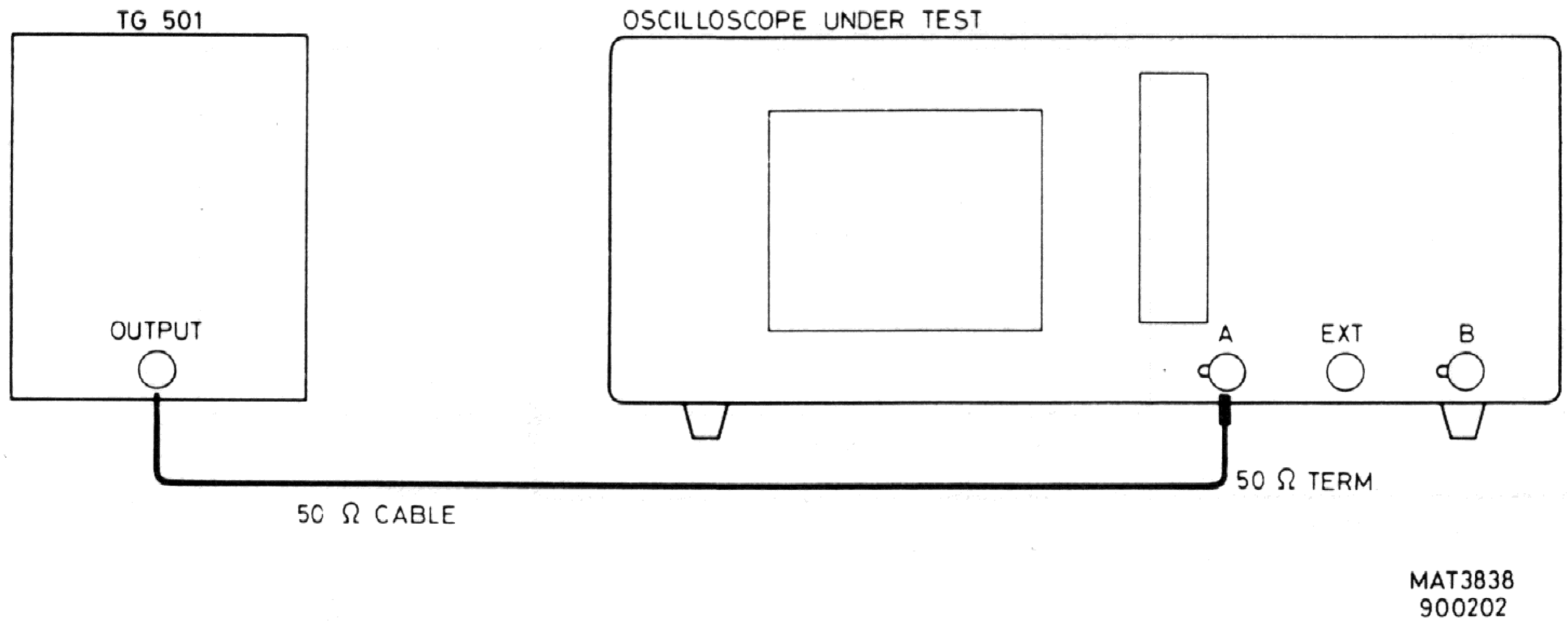
20.3.21 Horizontal deflection; variable control ratio (VAR TB)

The horizontal deflection coefficients can be varied by a variable control. Here, the range of this control is checked.

test equipment:

Time marker generator (TG 501)

test set-up:



settings/procedure:

1 – Apply a 1 μs time marker signal to input A; use a 50 Ω termination.
2 – Press the AUTO SET button.
3 – Set TB to 0,2 μs/div and VAR to CAL; time marker on the first and sixth graticule line. (distance between markers 5 div)
4 – Turn the TB VAR fully counter clockwise.

requirements:

Verify that the second marker is placed between the second and third graticule line. This means that the VAR control overlaps the time-base steps 0,2 to 0,5 μs (ratio 2,5 : 1).

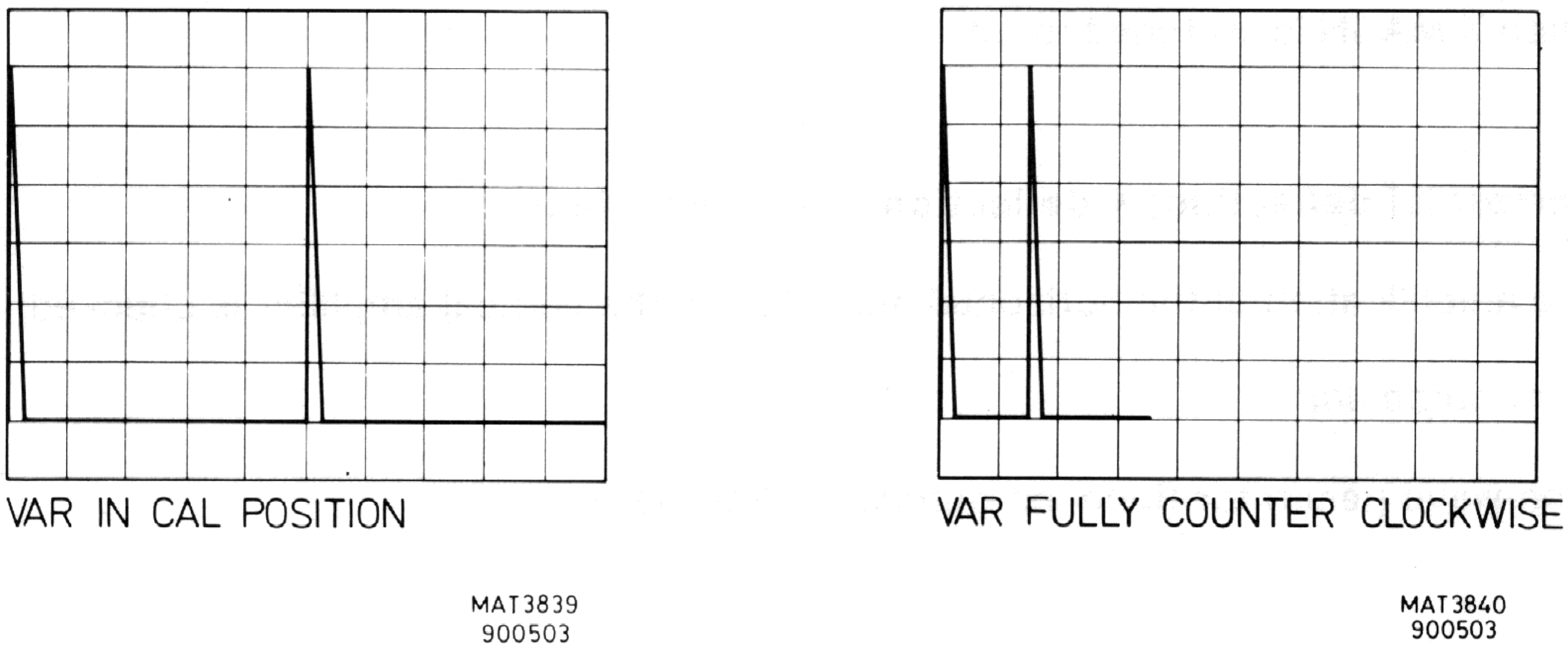


Figure 20.6 TB VAR range

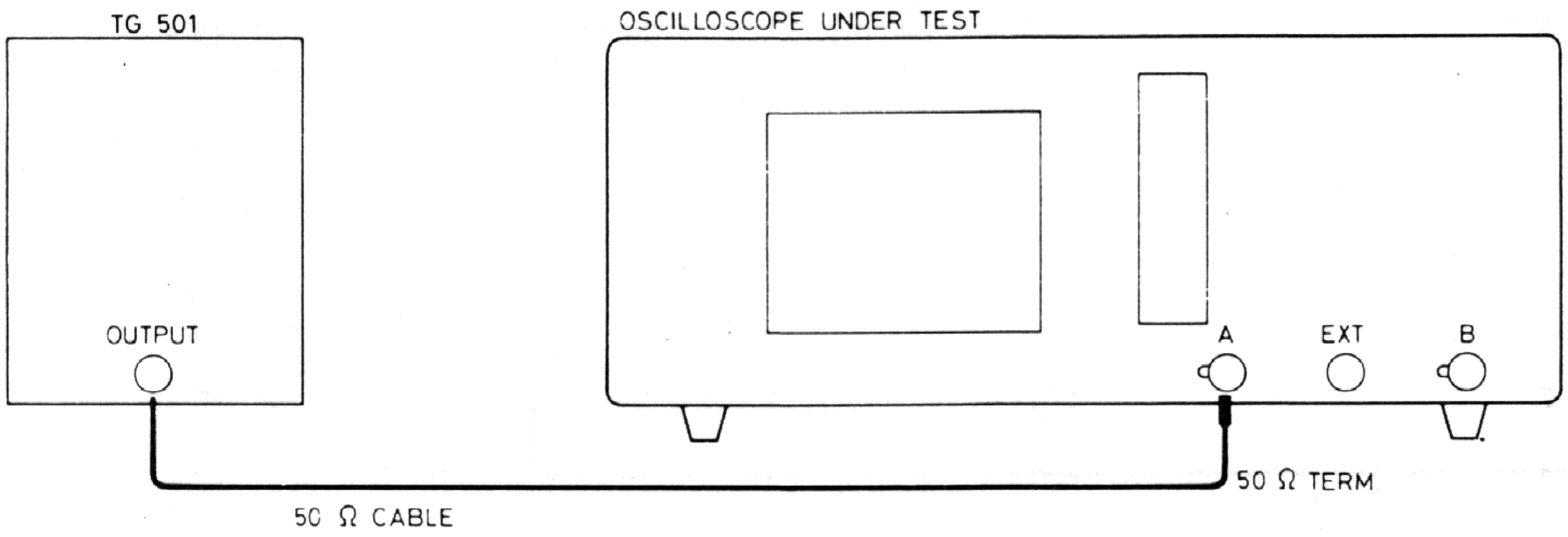
20.3.22 Horizontal deflection; TB magnifier balance

The magnitude of the horizontal amplification can be increased by 10. When switching from x1 to x10 a certain shift can appear. The maximum allowed shift is checked here.

test equipment:

Time marker generator (TG 501)

test set-up:



MAT3838
900202

settings/procedure:

1 – Apply a 1 μs time marker signal to input A; use a 50 Ω termination.
2 – Set TB to 0,2 μs/div and VAR to CAL; time marker on the first and sixth graticule line.
3 – Set X MAGN on.
4 – Set the top of the second marker pulse exactly at the vertical centre of the graticule.
5 – Set X MAGN to off.

requirements:

Verify that the top of the second marker pulse is not shifted more than 0,5 div, when X MAGN is switched to off.

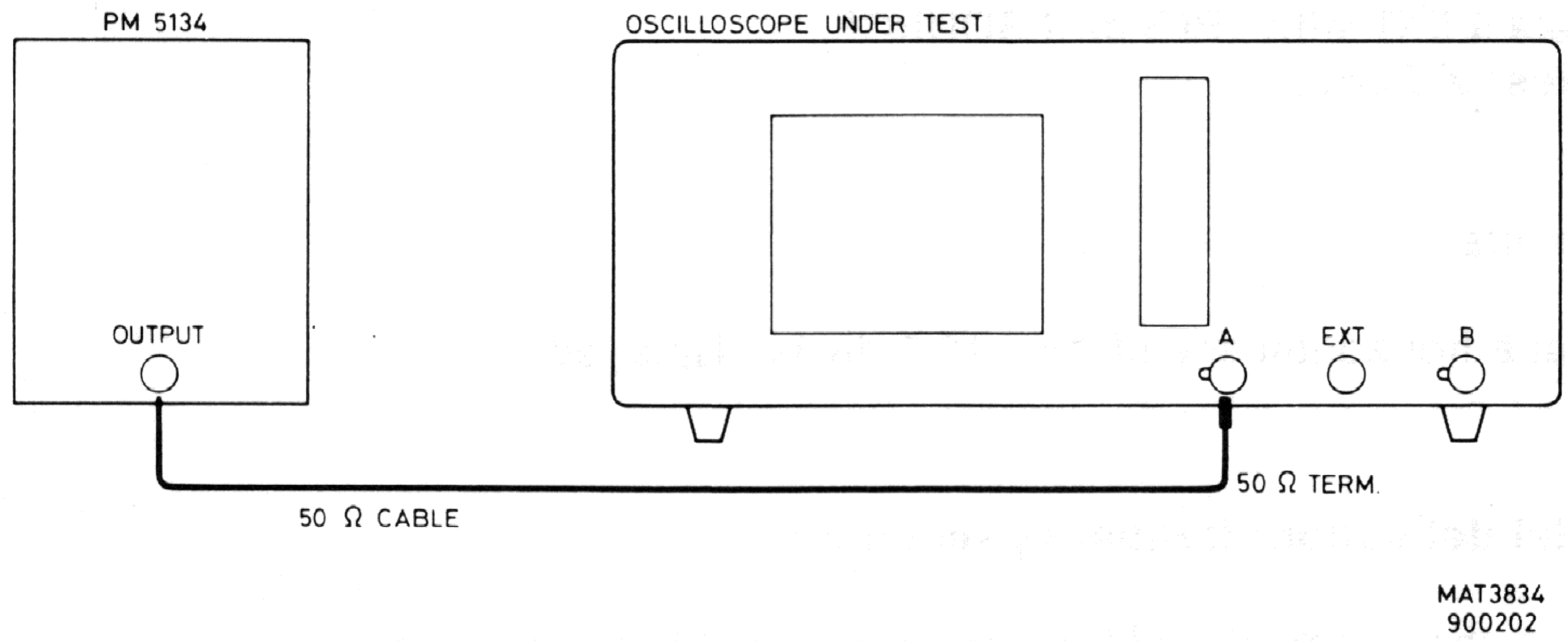
20.3.23 Horizontal deflection; X deflection coefficient via A

The amplification of the horizontal amplifier via the vertical amplifier is checked.

test equipment:

Sine-wave generator (function generator, PM 5134)

test set-up:



settings/procedure:

1 – Apply a 2 kHz sine-wave signal of 800 mV (pp) to input A; use a 50 Ω termination.
2 – Press the AUTO SET button.
3 – Set for a trace-height of 4 div.
4 – Press X DEFL.
5 – Press A/B twice for only channel B display.

requirements:

Verify that a horizontal line of 3,8...4,2 div is displayed.

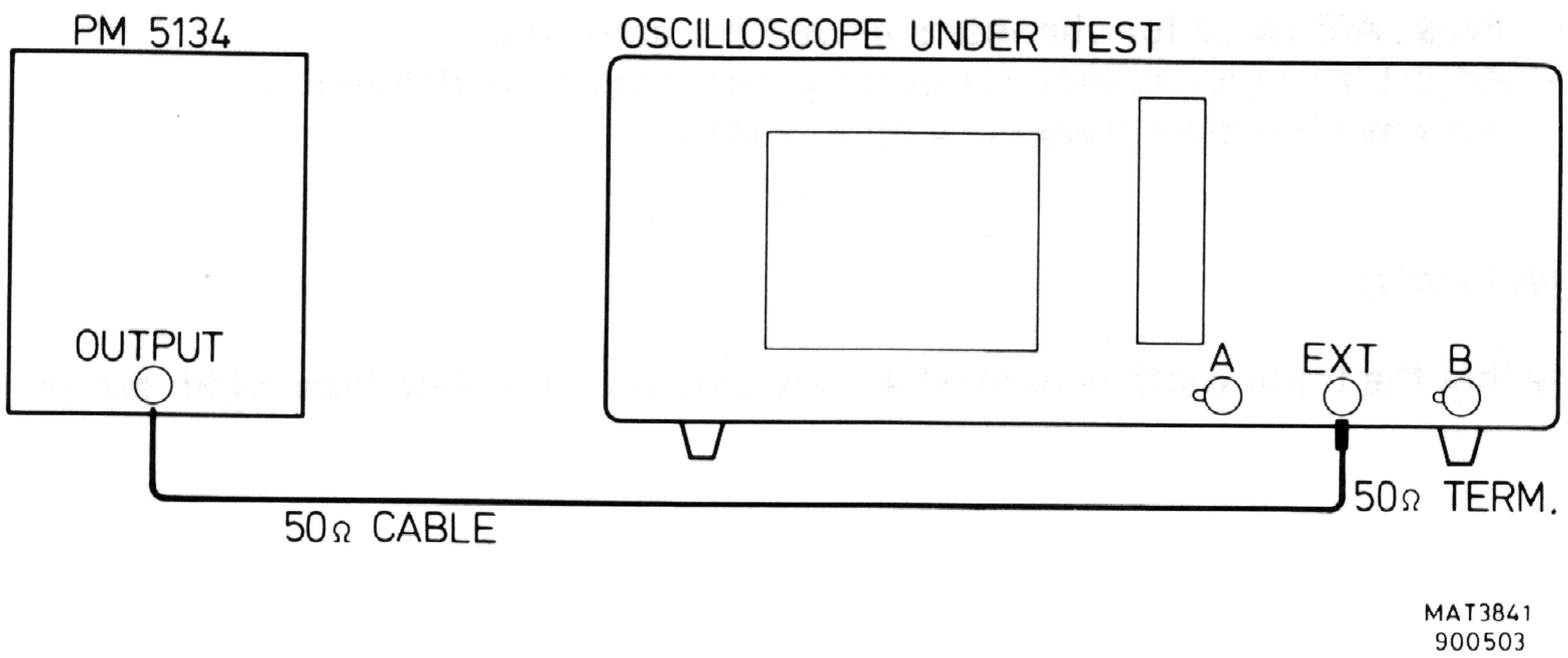
20.3.24 Horizontal deflection; X deflection coefficient via EXT

The amplification of the horizontal amplifier via the external input is checked.

test equipment:

Sine-wave generator (function generator, PM 5134)

test set-up:



settings/procedure:

1 – Apply a 2 kHz sine-wave signal of 1 V (pp) to input EXT; use a 50 Ω termination.
2 – Select EXT with TRIG or X SOURCE.
3 – Press X DEFL.

requirements:

Verify that a horizontal line of 9,5...10,5 div is displayed.

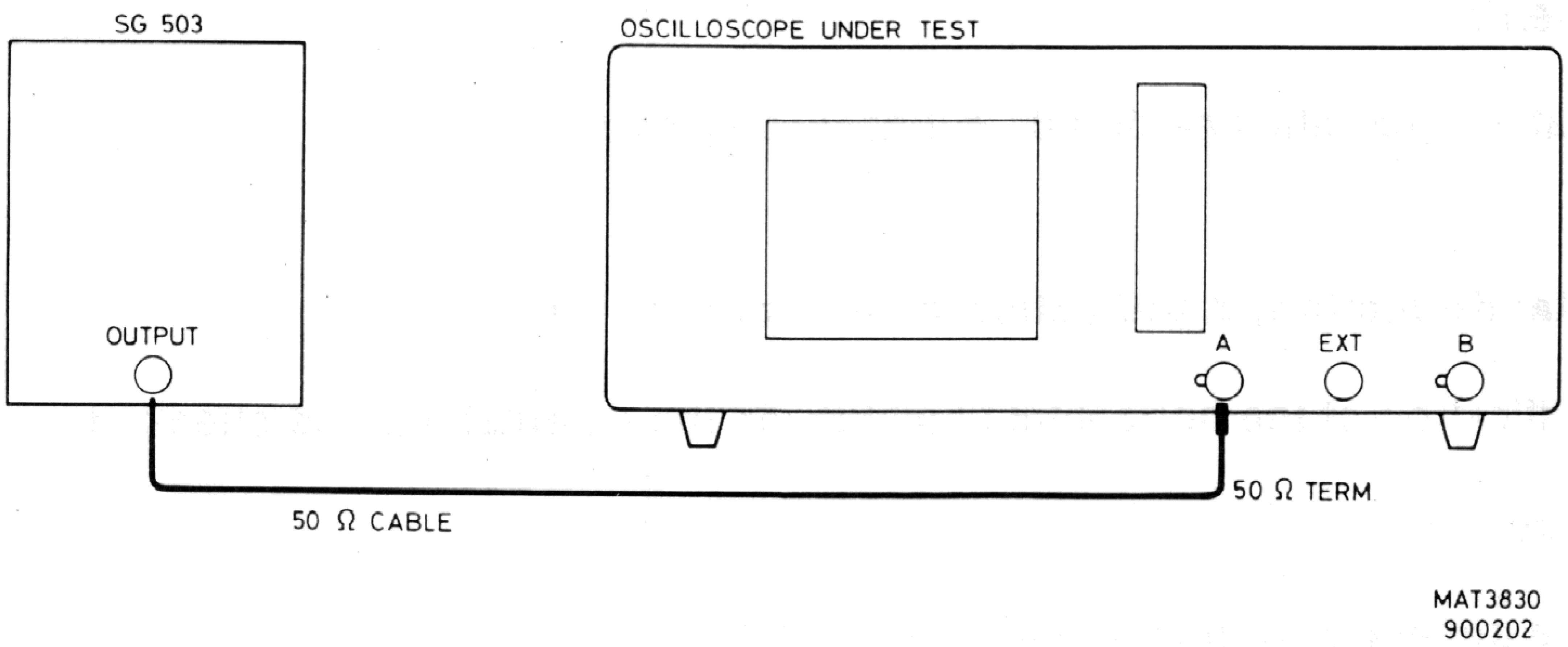
20.3.25 Horizontal deflection; frequency response 1

In this test, the bandwidth of the horizontal amplifier is verified.

test equipment:

Constant amplitude sine-wave generator (SG 503).

test set-up:



settings/procedure:

1 – Apply a 50 kHz sine-wave signal of 30 mV (pp) to input A; use a 50 Ω termination.
2 – Press the AUTO SET button and set A to 5 mV/div.
3 – Press X DEFL.
4 – Press A/B twice for channel B as vertical deflection.
5 – Adjust the input voltage for exactly 6 div horizontal deflection.
6 – Increase the input frequency up to 2 MHz.

requirements:

Verify that the trace width is at least 4,2 div over the complete bandwidth range.

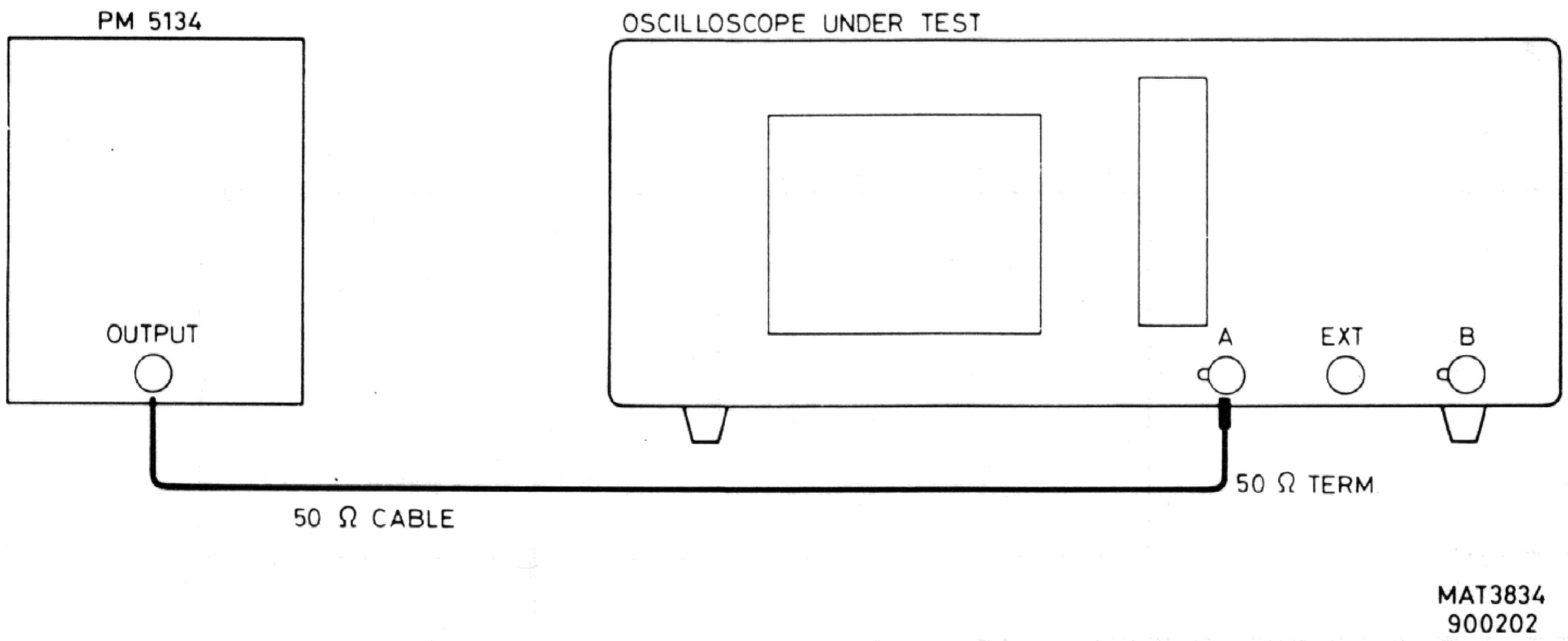
20.3.26 Horizontal deflection; frequency response 2

In this test, the function of the horizontal amplifier at low frequencies is checked.

test equipment:

LF sine-wave generator (function generator, PM 5134)

test set-up:



settings/procedure:

1 – Apply a 10 Hz sine-wave signal of 30 mV (pp) to input A; use a 50 Ω termination.
2 – Press the AUTO SET button and set A to 5 mV/div.
3 – Set the vertical deflection of A to exactly 6 div.
4 – Select X DEFL.
5 – Press A/B twice for channel B as vertical deflection.

requirements:

Ensure that the trace width is at least 4,2 div.

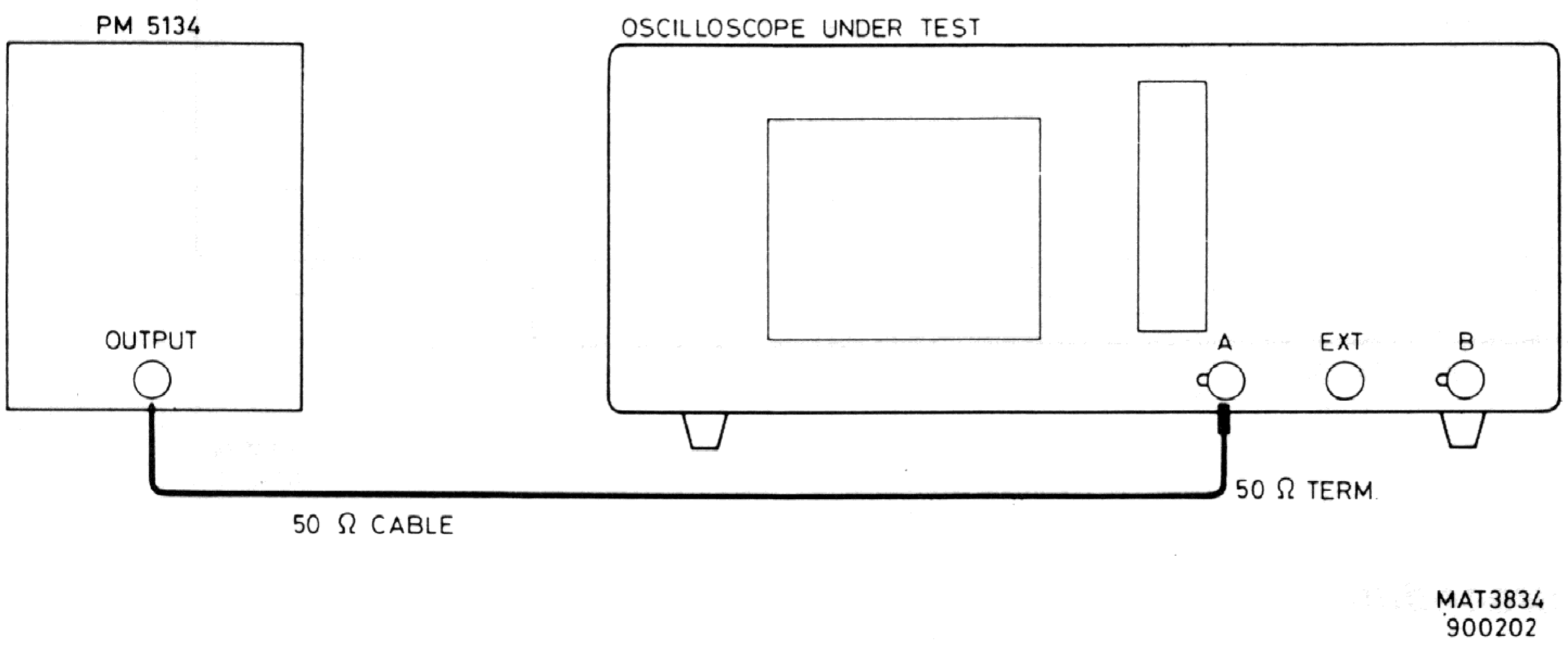
20.3.27 Maximum phase shift between horizontal and vertical deflection

There will be a certain phase shift between the horizontal and vertical amplifier.
The value of this shift is measured here.

test equipment:

LF sine-wave generator (function generator, PM 5134)

test set-up:



settings/procedure:

1 – Apply a 2 kHz sine-wave signal of 1,2 V (pp) to channel A; use a 50 Ω termination.
2 – Press the AUTO SET button and set for a trace-height of exactly 6 div.
3 – Press X DEFL.
4 – Increase the input frequency to 100 kHz.

requirements:

Verify that the phase shift is less than 3°, (see figure 20.6).

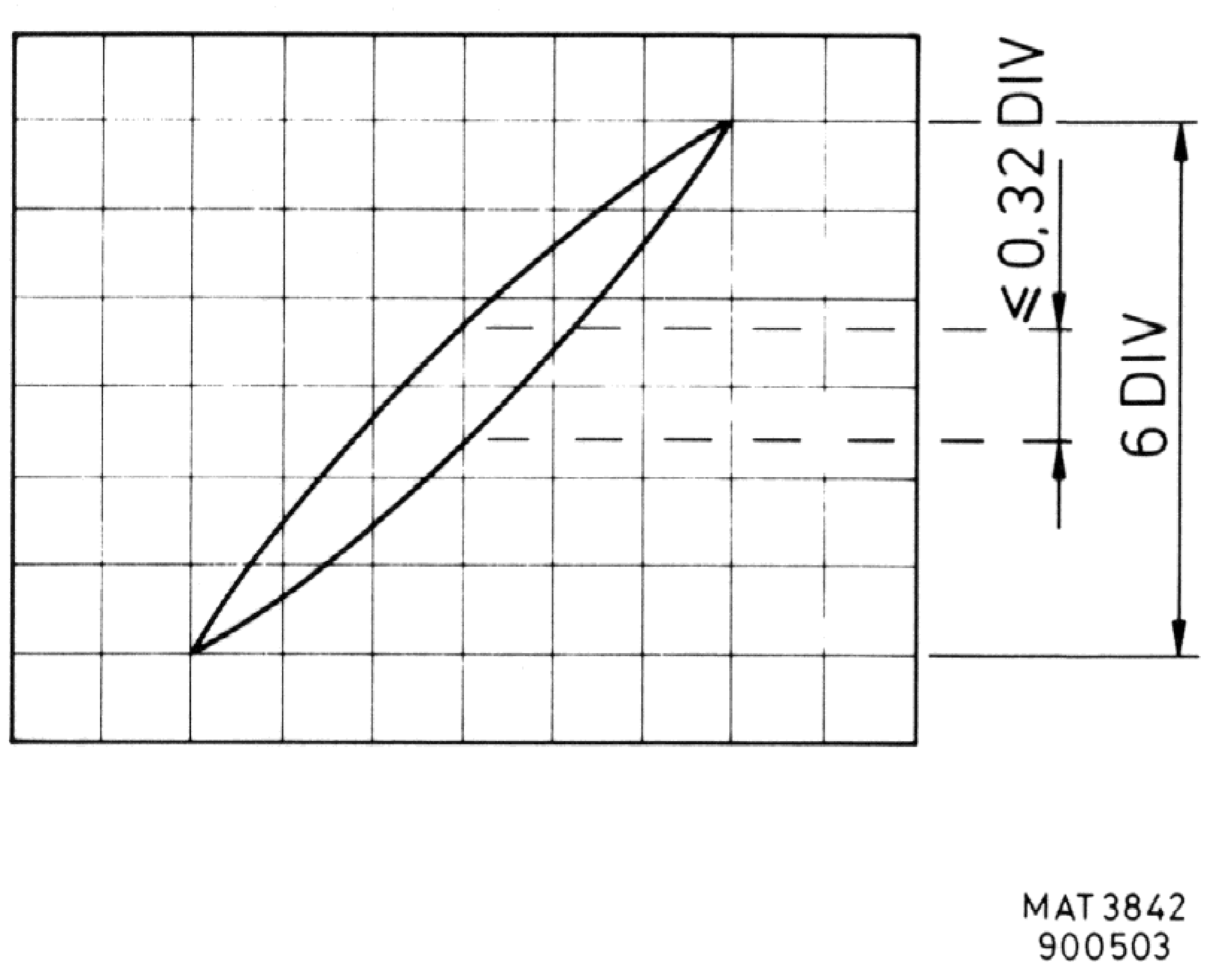


Figure 20.7 Phase shift

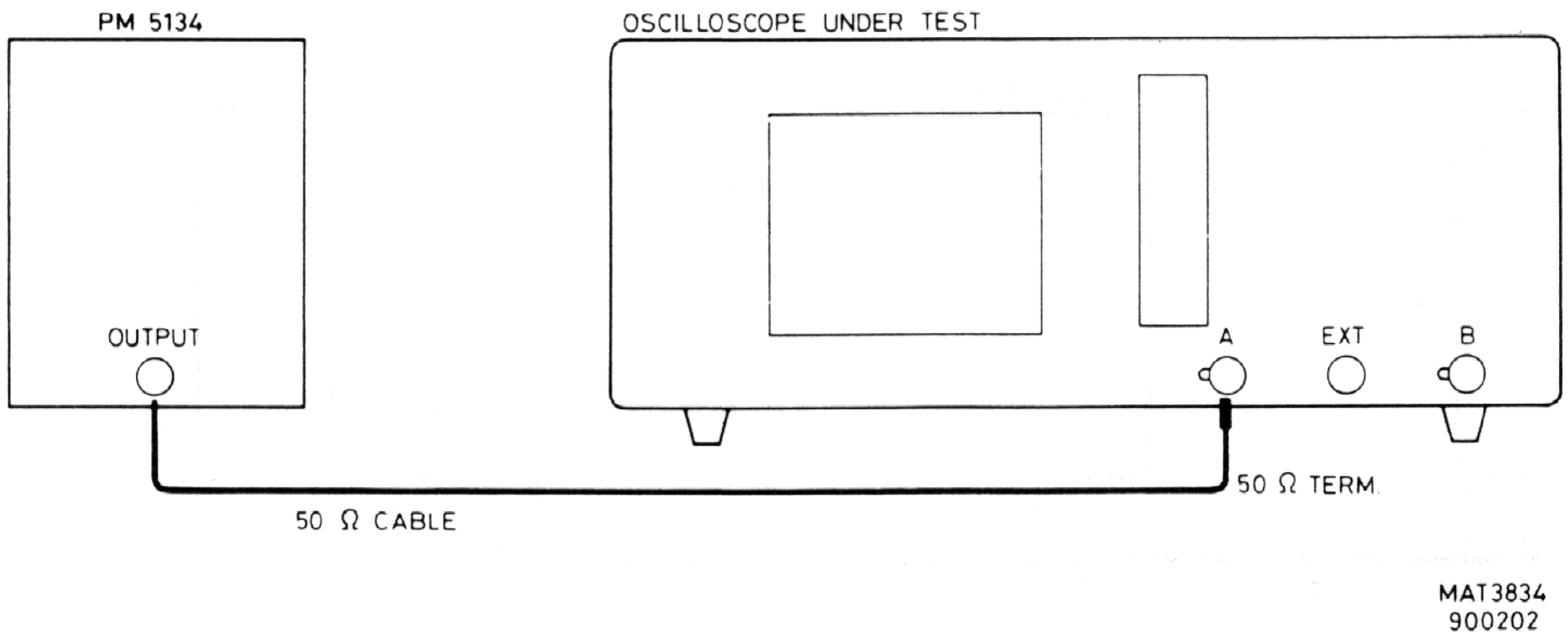
20.3.28 Triggering; sources and coupling

In this test, the various trigger sources and coupling modes are tested.

test equipment:

Sine-wave generator (function generator, PM 5134)

test set-up:



settings/procedure
and requirements:

1 – Apply a 2 kHz sine-wave signal of 800 mV (pp) to input A; use a 50 Ω termination.
2 – Press AUTO SET and set the trace-height to 4 div.
3 – Press TRIG COUPL and select DC.
4 – Adjust TRIG LEVEL for a triggered signal.
5 – Check that a sine-wave signal of 4 div is displayed.
6 – Press TRIG COUPL and select p-p.
7 – Turn TRIG LEVEL and check that the signal is triggered over the complete range of this control.
8 – Connect the CAL signal to input B.
9 – Press A/B to display both channels.
10 – Set channel B to 0,2 V/div.
11 – Select B as trigger source with TRIG or X SOURCE, (A is not triggered, B is triggered now).
12 – Check that a square-wave of 6 div is displayed.
13 – Increase the input frequency to input A to 20 kHz (CAL signal to B).
14 – Press TRIG or X SOURCE 4 times, (A and B selected).
15 – Check that 2 well-triggered traces are displayed.

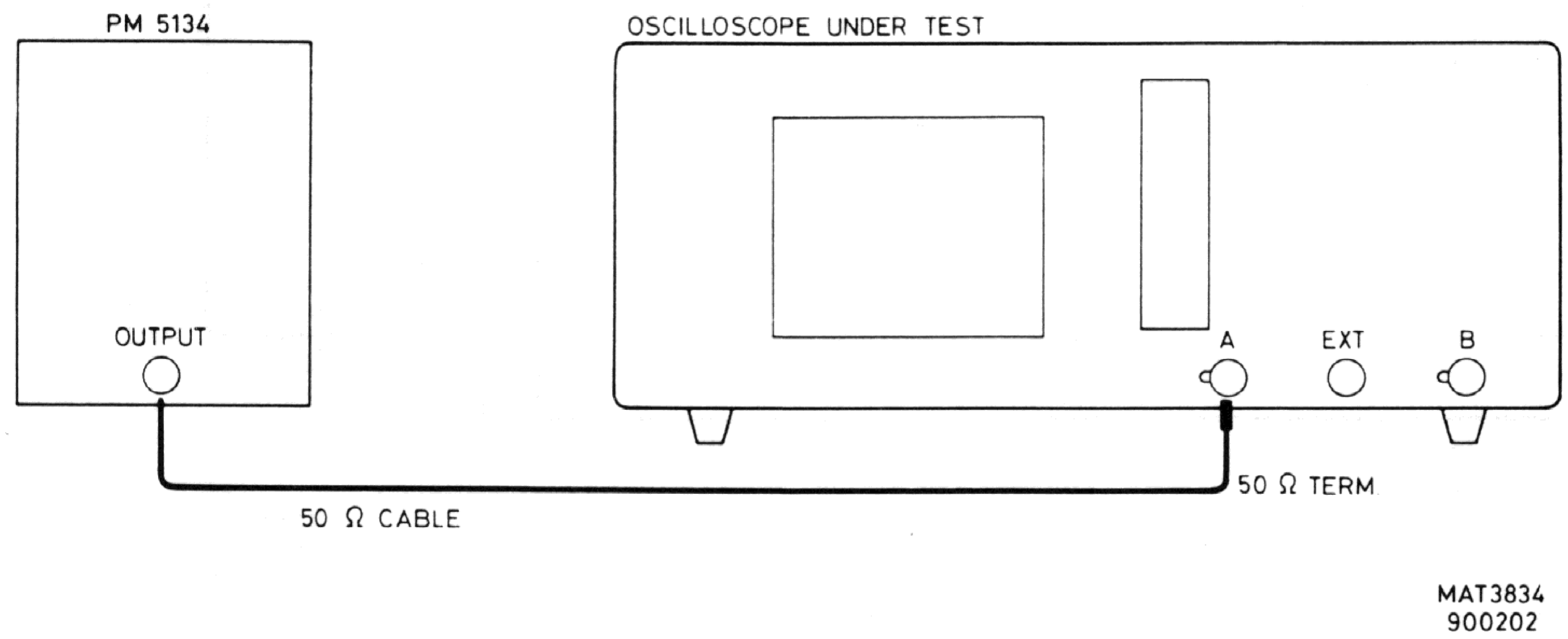
20.3.29 Triggering; slope selection and level control range

This test checks the range of the trigger level control and the correct working of the slope selection.

test equipment:

- LF sine-wave generator (function generator, PM 5134)
- T-piece

test set-up:



settings/procedure and requirements:

1 – Apply a 2 kHz sine-wave signal of 1,6 V (pp) to input A; use a 50 Ω termination.
2 – Set A to 0,2 V/div at DC input coupling.
3 – Set TRIG COUPL for p-p triggering.
4 – Turn TRIG LEVEL fully clockwise and fully counter clockwise.
5 – Check that the signal is well-triggered over the complete TRIG LEVEL range.
6 – Set the TRIG LEVEL control in its mid-position.
7 – The start of the signal display must be in the vertical centre.
8 – Press TB TRIG MODE.
9 – Press SLOPE. (_/‾ ‾_)
10 – Check that the sine-wave signal is inverted and that it is triggered on the negative slope.
11 – Press SLOPE once again.
12 – Press TRIG COUPL for DC coupling.
13 – Set A to 100 mV/div (16 div trace-height).
14 – Turn the TRIG LEVEL.
15 – Verify that the LEVEL range is more than +8 div and – 8 div and that the signal is triggered on the positive slope. Use Y POS control.

Repeat this procedure for channel B.

Repeat this procedure for the same signal to inputs A and EXT together, by means of a T-piece.

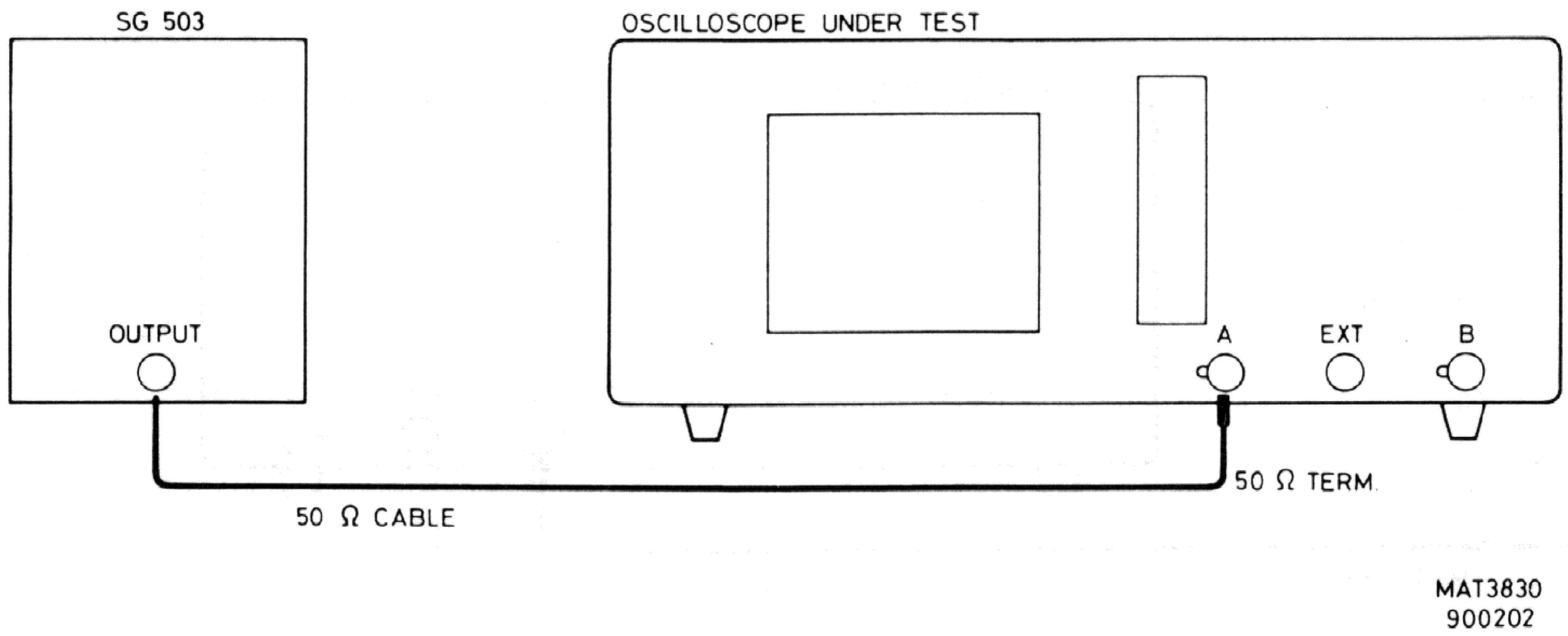
20.3.30 Triggering; trigger sensitivity via A and B

The trigger sensitivity depends on the amplitude and frequency of the trigger signal. In this test the sensitivity via the A and B inputs is checked.

test equipment:

Constant amplitude sine-wave generator (SG 503)

test set-up:



settings/procedure
and requirements:

1 – Apply a 10 MHz sine-wave signal of 250 mV (pp) to input A; use a 50 Ω termination.
2 – Press AUTO SET and set A to 0,2 V/div.
3 – Set AC/DC coupling of A to DC.
4 – Press TB TRIG MODE for TRIG mode.
5 – Press TRIG COUPL for DC trigger coupling.
6 – Turn TRIG LEVEL for a well-triggered signal.
7 – Decrease the amplitude of the input signal.
8 – Verify that the signal is well-triggered at amplitudes of 0,5 div and more.
9 – Decrease the input frequency to 50 kHz.
10 – Verify that the signal stays well-triggered at amplitudes of 0,5 div and more.
11 – Increase the input frequency to 50 MHz.
12 – Increase the input voltage to 1 div.
13 – Turn TRIG LEVEL.
14 – Verify that the signal is well-triggered at amplitudes of 1 div and more.
15 – Increase the input frequency to 100 MHz.
16 – Increase the input voltage to 3 div.
17 – Verify that the signal is well-triggered at amplitudes of 3 div and more.

Repeat this procedure for channel B.

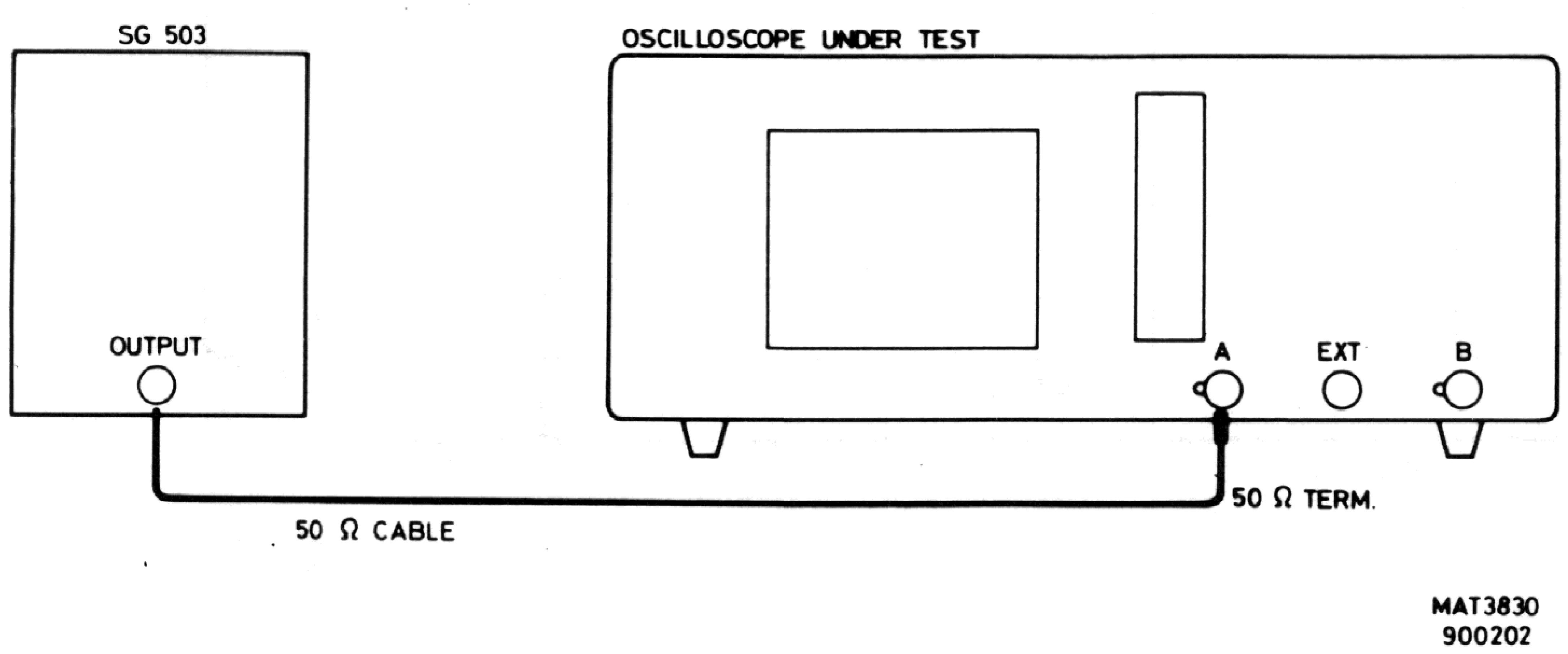
20.3.31 Triggering; trigger sensitivity via EXT

The trigger sensitivity depends on the amplitude and frequency of the trigger signal. In this test the sensitivity via the trigger input EXT is checked.

test equipment:

- Constant amplitude sine-wave generator (SG 503)
- T-piece

test set-up:



settings/procedure and requirements:

1 – Apply a 10 MHz sine-wave signal of 250 mV (pp) to input A; use a 50 Ω termination.
2 – Press AUTO SET and set A to 0,2 V/div.
3 – Set AC/DC coupling of A to DC and connect the input signal, by means of a T-piece, to inputs EXT and A together.
4 – Press TB TRIG MODE for TRIG mode.
5 – Press TRIG COUPL for DC trigger coupling.
6 – Turn TRIG LEVEL for a well-triggered signal.
7 – Decrease the amplitude of the input signal.
8 – Verify that the signal is well-triggered at amplitudes of 50 mV and more.
9 – Decrease the input frequency to 50 kHz.
10 – Verify that the signal stays well-triggered at amplitudes of 50 mV and more.
11 – Increase the input frequency to 50 MHz.
12 – Increase the input voltage to 150 mV.
13 – Turn TRIG LEVEL.
14 – Verify that the signal is well-triggered at amplitudes of 150 mV and more.
15 – Increase the input frequency to 100 MHz.
16 – Increase the input voltage to 500 mV.
17 – Verify that the signal is well-triggered at amplitudes of 500 mV and more.

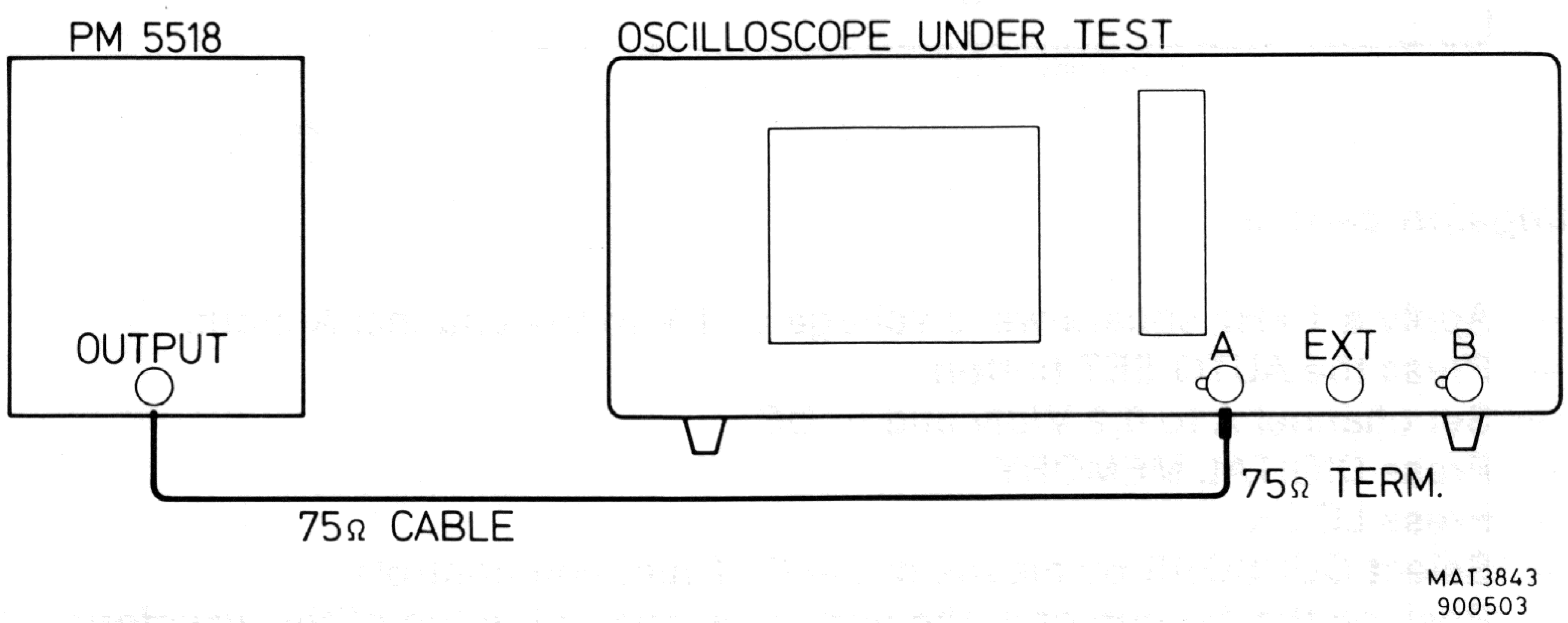
20.3.32 Triggering; trigger sensitivity TVL-TVF

This test checks the trigger sensitivity for television line- and frame signals.

test equipment:

TV pattern generator with video output (PM 5518)

test set-up:



settings/procedure:

1 – Apply a video signal to input A with an amplitude of 0,7 div sync pulse amplitude; use a 75 Ω termination.
2 – Press the AUTO SET button.
3 – Press TB TRIG mode for TRIG mode.
4 – Press AC/DC for DC input coupling.
5 – Press TRIG COUPL for TVL and TVF.

requirements:

Check for a stable triggering on the narrow TVL and the wide TVF pulse at sync amplitudes of 0,7 V.

Repeat settings/procedure for channel B.

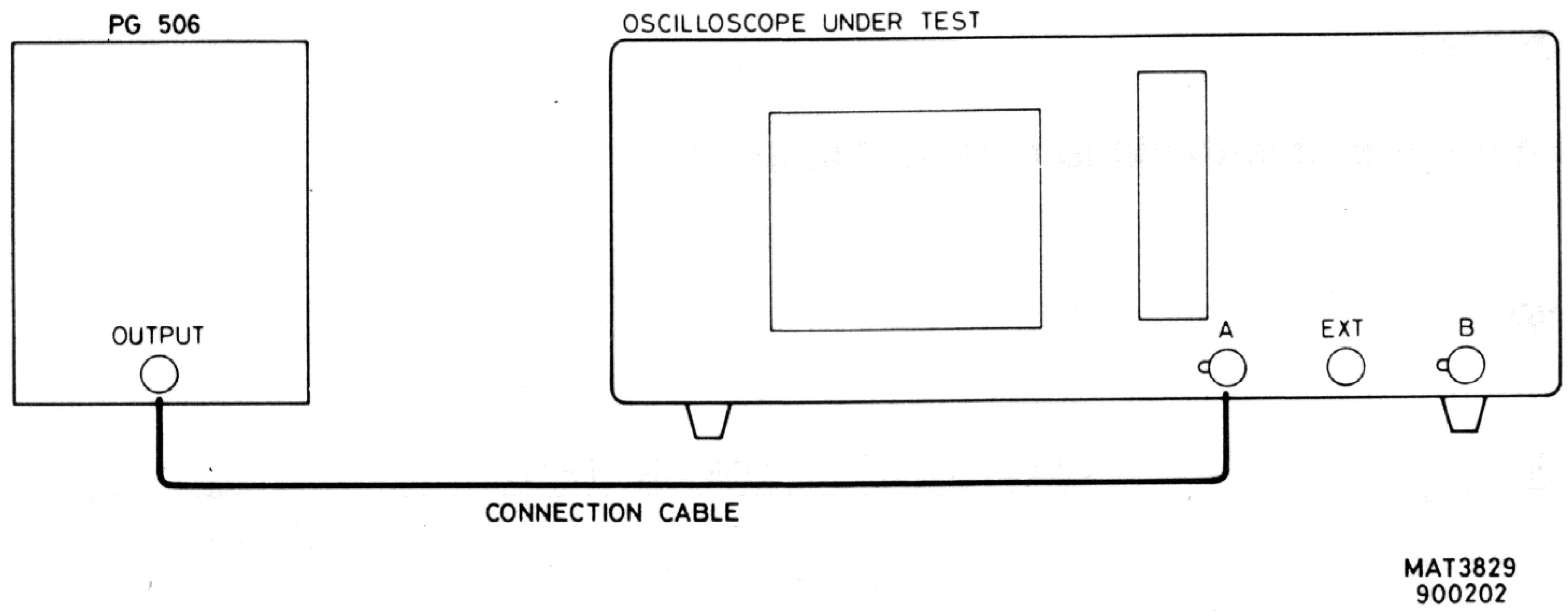
20.3.33 Cursors; voltage cursor accuracy

In this test the accuracy of the voltage cursors is checked.

test equipment:

Square-wave calibration generator (PG 506)

test set-up:



settings/procedure:

1 – Apply a 1 kHz square-wave voltage of 1 V to the channel A input.
2 – Press the AUTO SET button.
3 – Set channel A to 0,2 V/div and to DC.
4 – Press DIGITAL MEMORY.
5 – Press LOCK.
6 – Select CURSORS by means of the CRT function controls.
7 – Position the 1st cursor in the horizontal mid of the top of the waveform.
8 – Position the 2nd cursor in the horizontal mid of the bottom of the waveform.

requirements:

Verify that the voltage cursor read-out at the top of the screen is 0,97...1,03 V.

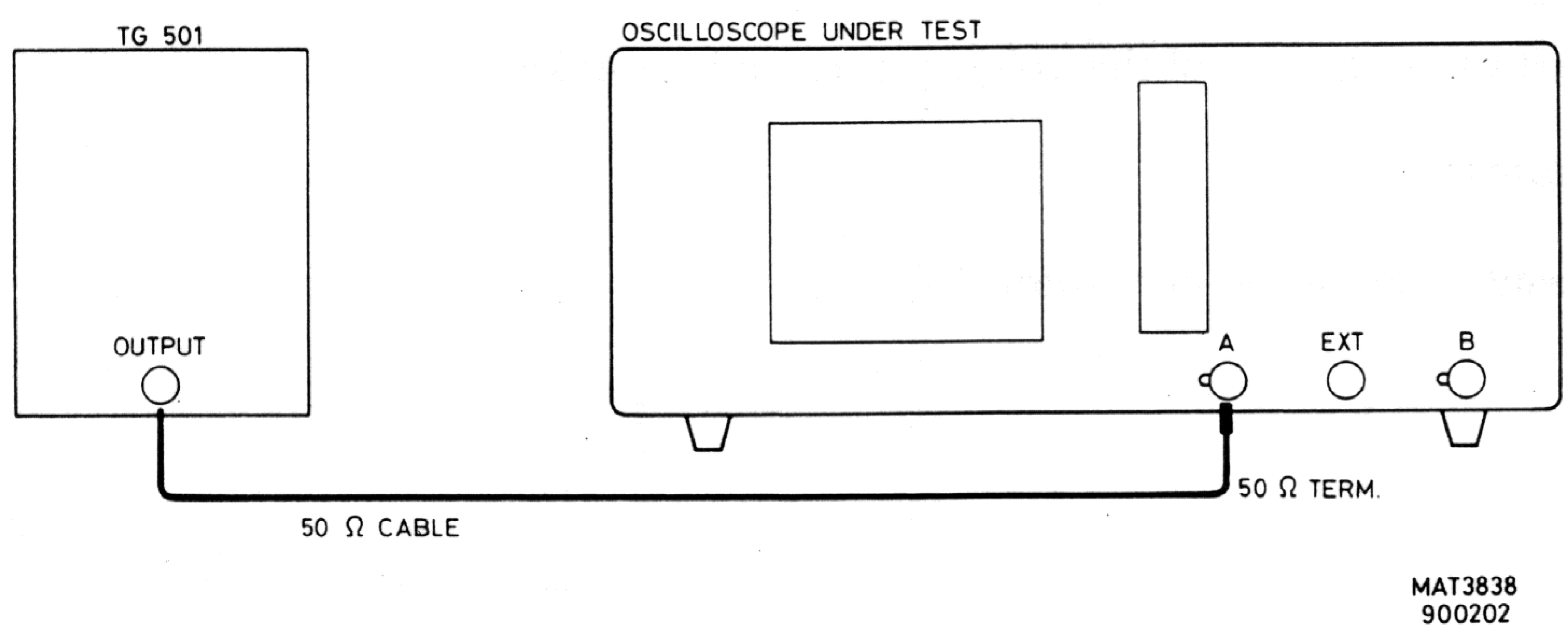
20.3.34 Cursors; time cursor accuracy

In this test the accuracy of the time cursors is checked.

test equipment:

Time marker generator (TG 501)

test set-up:



settings/procedure:

1 – Apply a 1 ms time marker signal to input A; use a 50 Ω termination.
2 – Press the AUTO SET button.
3 – Press DIGITAL MEMORY.
4 – Set TB to 1 ms/div.
5 – Press LOCK.
6 – Select CURSORS by means of the CRT function controls.
7 – Position the 1st and 2nd cursor so that they cover a distance of 8 time marker intervals; position the markers exactly to the top of the marker pulses.

requirements:

Check for a time cursor read-out of 7,99...8,01 ms.

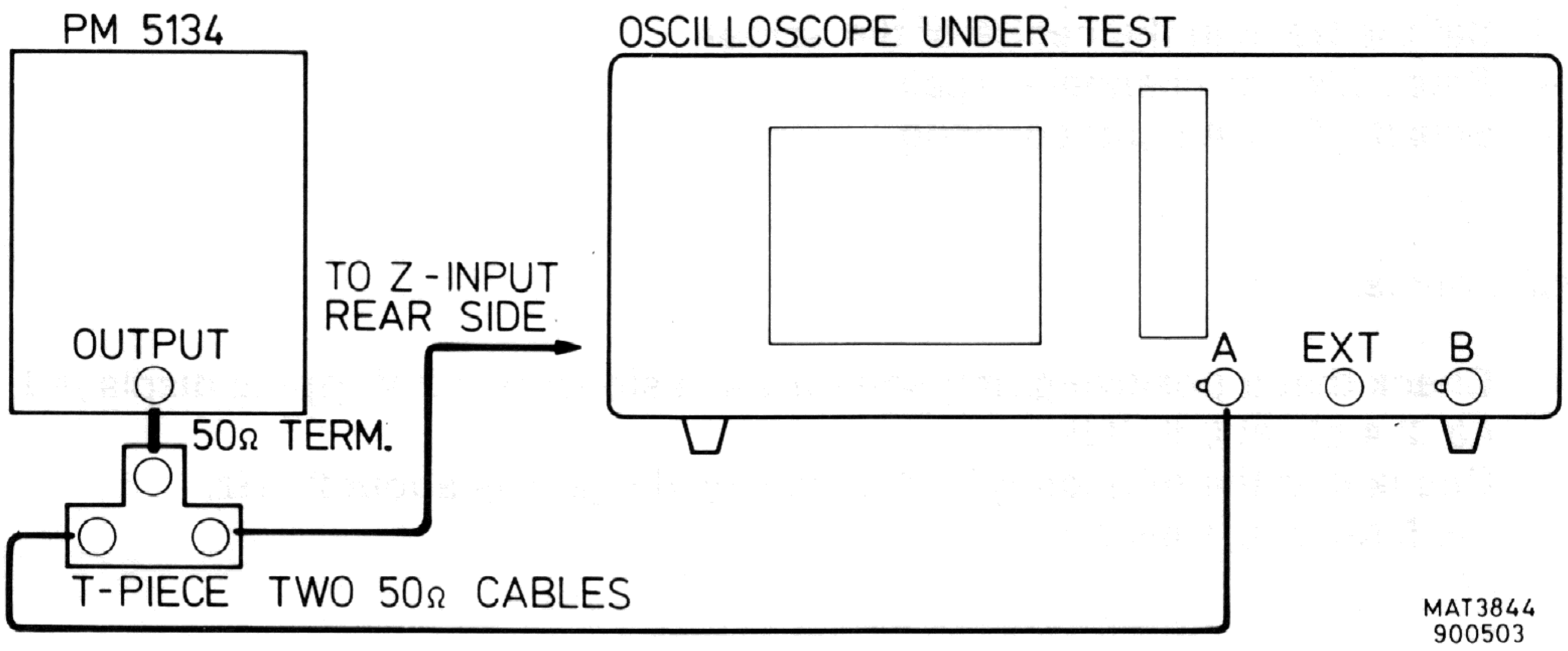
20.3.35 Z-MOD sensitivity

This test checks the sensitivity of the Z modulation facility.

test equipment:

- Square-wave generator (function generator, PM 5134)
- T-piece

test set-up:



*settings/procedure
and requirements:*

1 – Apply a 1 kHz square-wave signal, duty cycle 50 %, amplitude 2,5 V, to input A.
2 – Press the AUTO SET button.
3 – Set TB to 0,5 ms/div.
4 – Set the trace of channel A in mid position.
5 – Apply the same signal by means of the T-piece to the Z-input (rear side).
6 – Check that only the bottom half of the square-wave signal is displayed. (500 μs blanking and 500 μs unblanking)
7 – Remove the Z-input.
8 – Decrease the input signal to 1 V.
9 – Reconnect the Z-input.
10 – Set A to 0,5 V /div.
11 – Check that the top half of the square-wave signal is visible with a lower intensity.
12 – Check that the top half of the signal is completely unblanked (visible with full intensity) at an input signal less than 0,8 V.

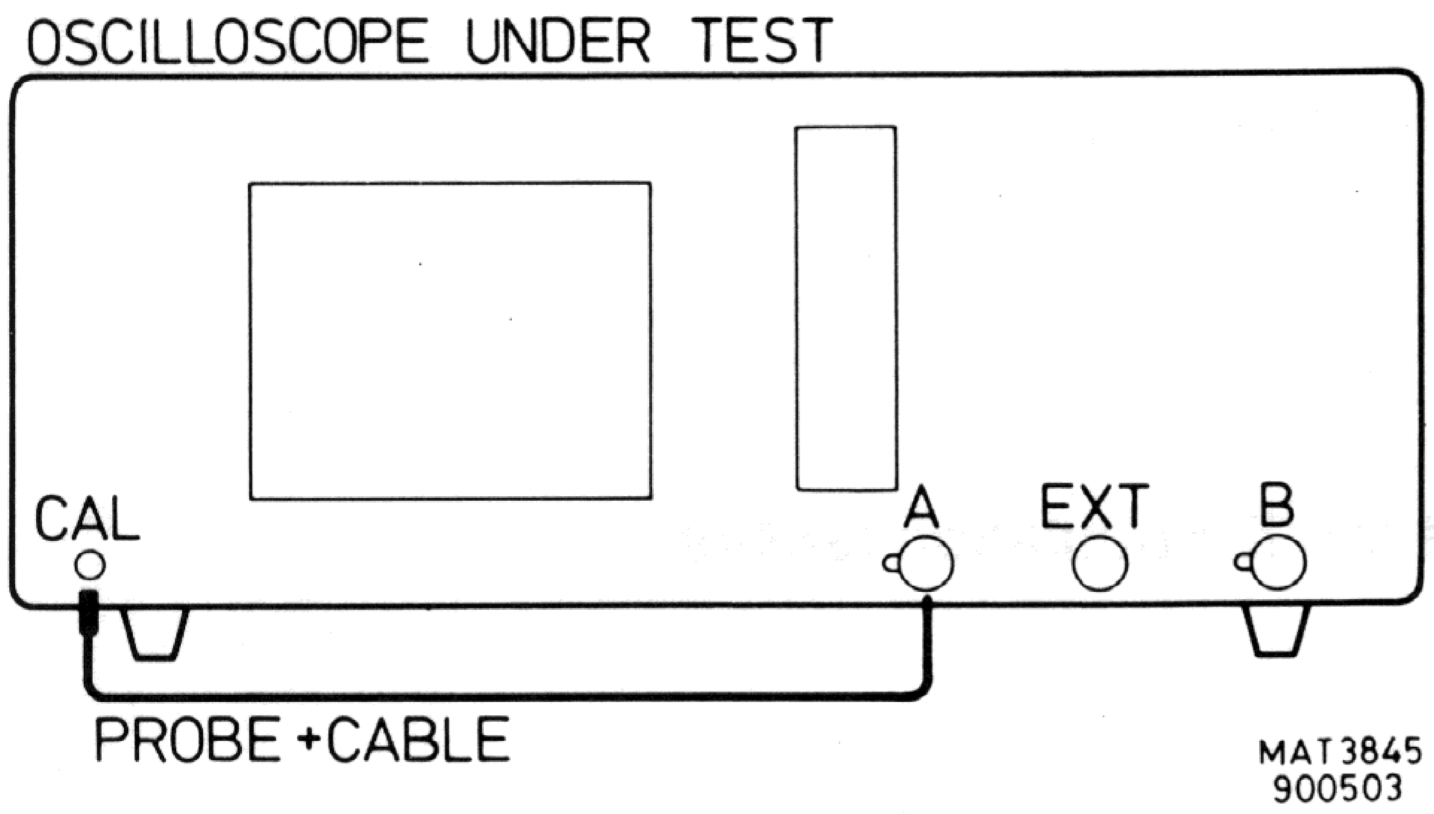
20.3.36 CAL signal; frequency and output voltage

The CAL signal is a calibration signal with fixed frequency and voltage. In this test, the values of frequency and voltage are checked.

test equipment:

None

test set-up:



settings/procedure:

1 – Connect the CAL signal to input A and press the AUTO SET button.
2 – Press GND of channel A.
3 – Set the trace in the centre of the screen.
4 – Press GND of channel A again.
5 – Select DC of A input coupling.

requirements:

1 – Check that a positive going square-wave signal of 1,2 V (pp) is displayed, i.e. 2,4 div at 0,5 V/div.
2 – Check that the frequency of the displayed signal is about 2 kHz, i.e. 5 div at 0,1 ms/div.

21 DISMANTLING THE INSTRUMENT

21.1 GENERAL INFORMATION

This section provides the dismantling procedures required for the removal of components during repair operations.
All circuit boards removed from the instrument must be adequately protected against damage, and all normal precautions regarding the use of tools must be observed.
During the dismantling a careful note must be made of all disconnected leads so that they can be reconnected to their correct terminals during assembly.

CAUTION: **Damage may result if:**
- The instrument is switched-on when a circuit board has been removed.
- a circuit board is removed within one minute after switching-off the instrument.

21.2 REMOVING THE TOP AND BOTTOM COVERS

The instrument is protected by two covers: a top cover and a bottom cover. To remove these covers, proceed as follows:

- Slacken the two screws that secure both covers, located at the rear of the instrument.
- Gently push each cover backwards until it can be lifted.
- The covers can be removed by lifting them clear of the instrument.

21.3 ACCESS TO THE ADJUSTING ELEMENTS

After removing both covers (section 21.2), the P^2CCD unit and the time base unit have to fix vertically in the chassis.

NOTE: To avoid damage of the flatcables, the metal bracket that fixes the P^2CCD unit have to be removed from the chassis first. Then you can easily fix the P^2CCD unit vertically in the chassis.

Next the digital unit (A10 ... A15) has to be removed out of the instrument. It can be placed beside the instrument using the metal cover as a bottom plate. The four already existing holes in this cover must be used to position the digital unit in this place.

If necessary, the power supply unit can be lifted out of the instrument. To do so, proceed as follows:

- Push both parts at the back of the extension shaft towards each other, so that the extension shaft can easily be loosened from the ON/OFF switch on the power supply unit.
- Remove the complete extension shaft.
- Push both lips that secure the power supply unit sidewards and gently lift this unit out of the instrument.
- Fix the power supply unit in the available p.c.b. guide fixing.

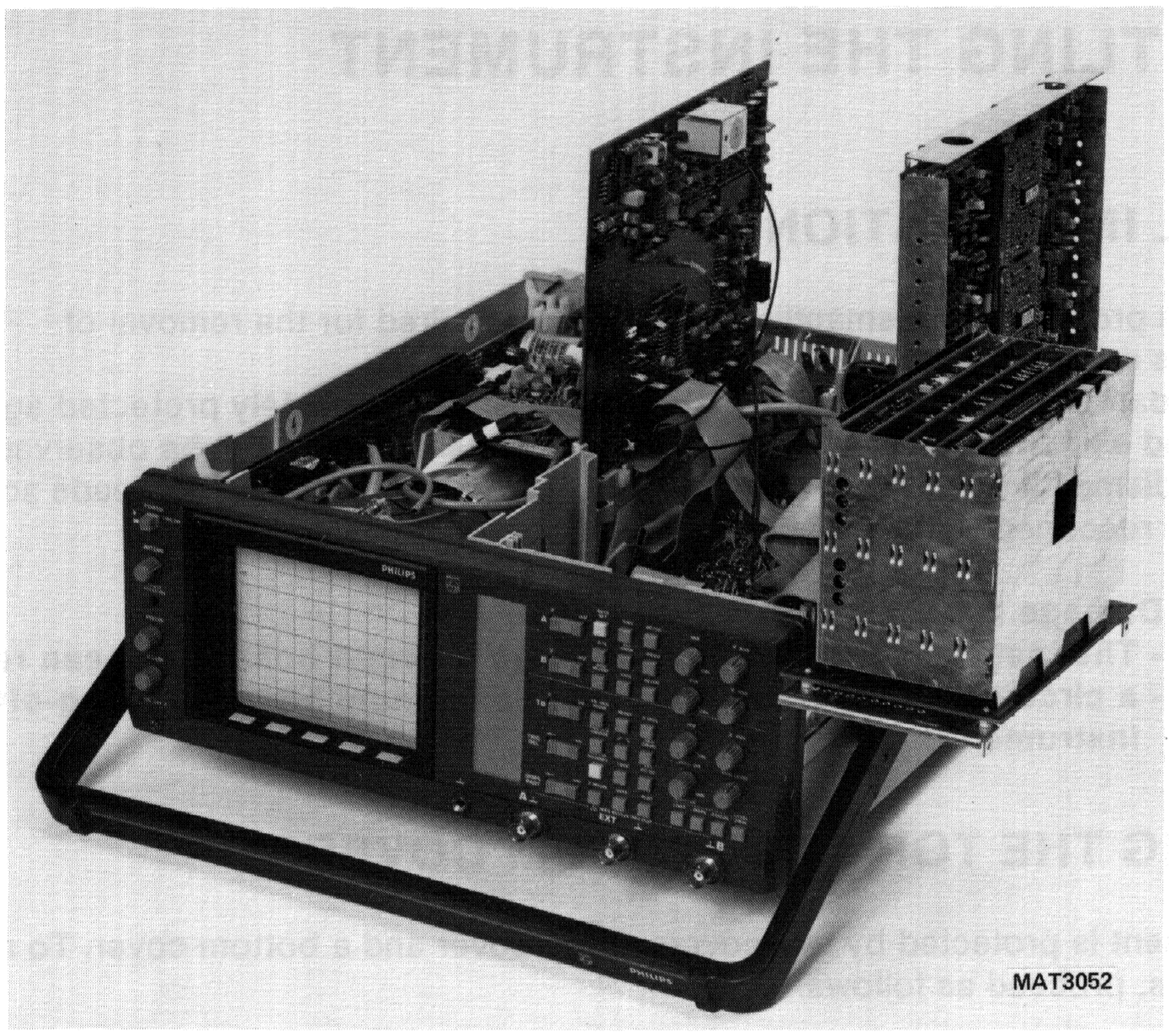


Figure 21.1 Access to all parts for checking and adjusting

NOTE: For checking and adjusting the instrument it is not necessary to remove the bottom cover.

22 CHECKING AND ADJUSTING

22.1 GENERAL INFORMATION

The following information provides the complete checking and adjusting procedure for the instrument. As various control functions are interdependent, a certain order of adjustment is necessary.
The procedure is, therefore, presented in a sequence which is best suited to this order, cross-reference being made to any circuit which may affect a particular adjustment.
Before any check or adjustment, the instrument must attain its normal operating temperature.

- Warming-up time under average conditions is 30 minutes.
- Where possible, instrument performance should be checked before any adjustment is made.
- All limits and tolerances given in this section are calibration guides, and should not be interpreted as instrument specifications unless they are also published in section 2.
- Tolerances given are for the instrument under test and do not include test equipment error.
- The most accurate display adjustments are made with a stable, well- focused low intensity display.
- All controls that are mentioned without item numbers are located on the outside of the instrument.

WARNING: The opening of covers or removal of parts, except those to which access can be gained by hand, is likely to expose live parts, and also accessible terminals may be live.
The instrument shall be disconnected from all voltage sources before any adjustment, replacement or maintenance and repair during which the instrument will be opened.
If afterwards any adjustment, maintenance or repair of the opened instrument under voltage is inevitable, it shall be carried out only by qualified person who is aware of the hazard involved.
Bear in mind that capacitors inside the instrument may still be charged even if the instrument has been separated from all voltage sources.

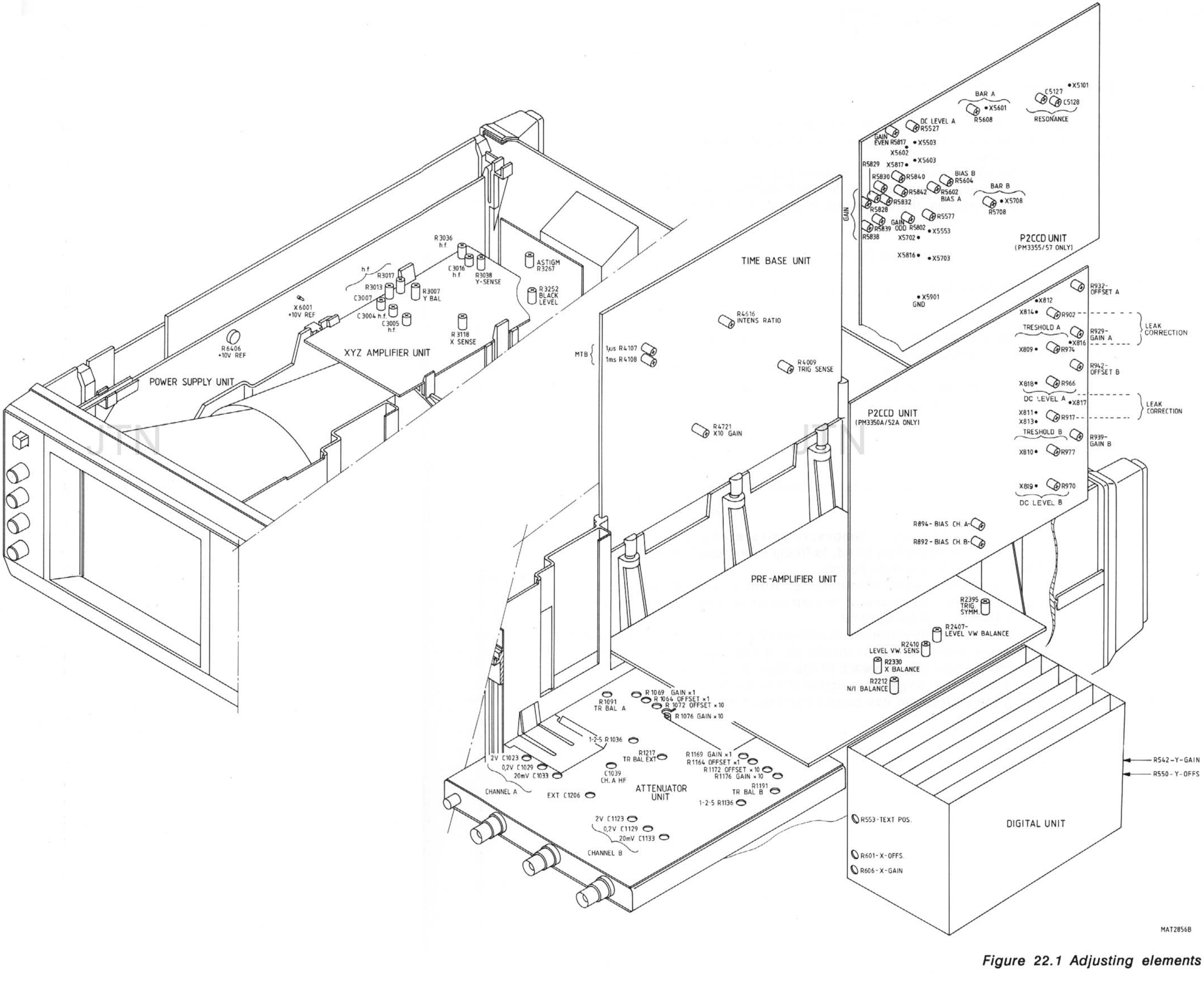
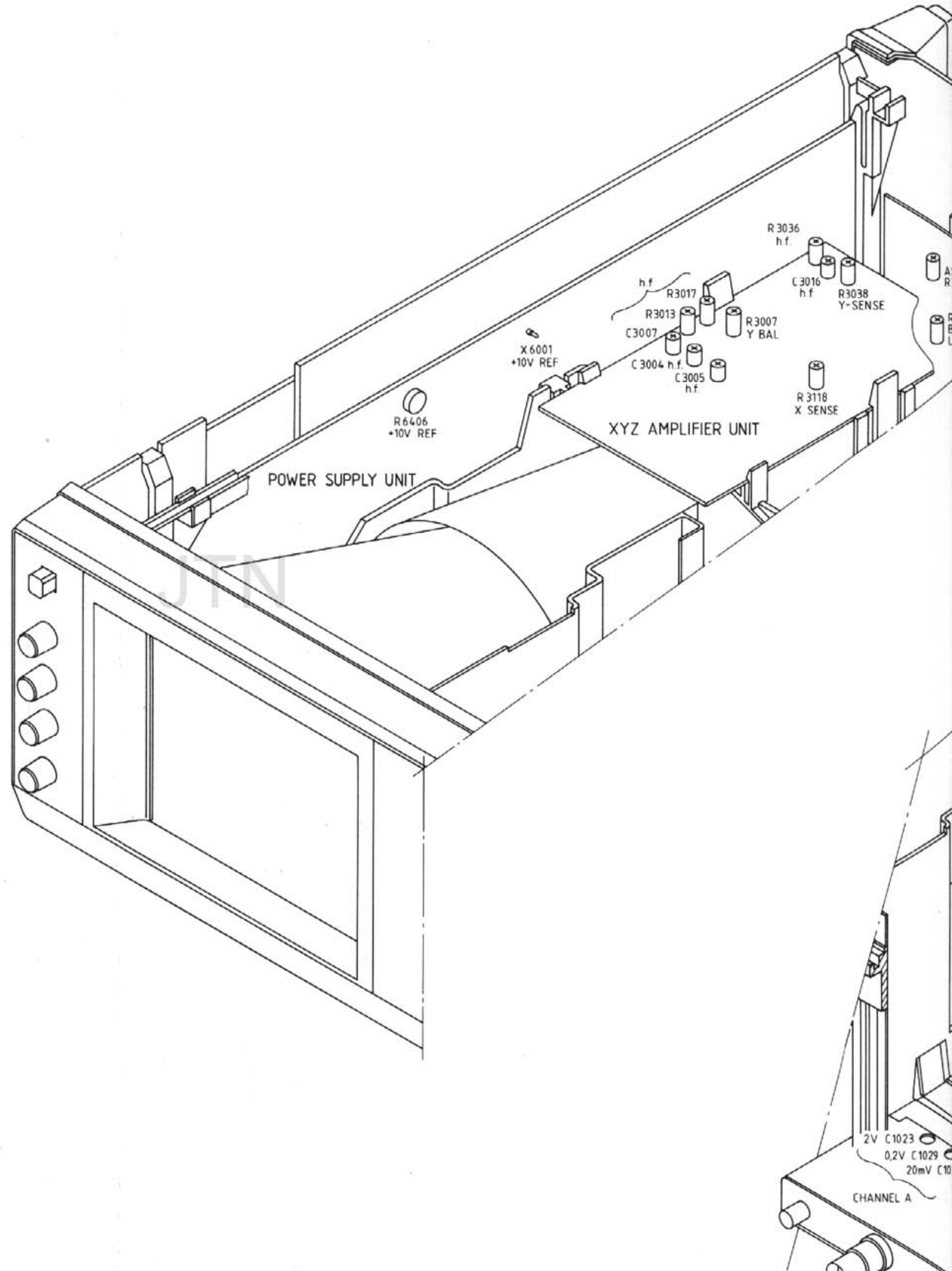


Figure 22.1 Adjusting elements


R 3036
h.f.
C3016
h.f.
R3038
Y-SENSE
h.f.
R3017
R3013
R3007
Y BAL
C3007
X 6001
+10V REF
C 3004 h.f.
C3005
h.f.
R 3118
X SENSE
R 6406
+10V REF
XYZ AMPLIFIER UNIT
POWER SUPPLY UNIT
2V C1023
0,2V C1029
CHANNEL A

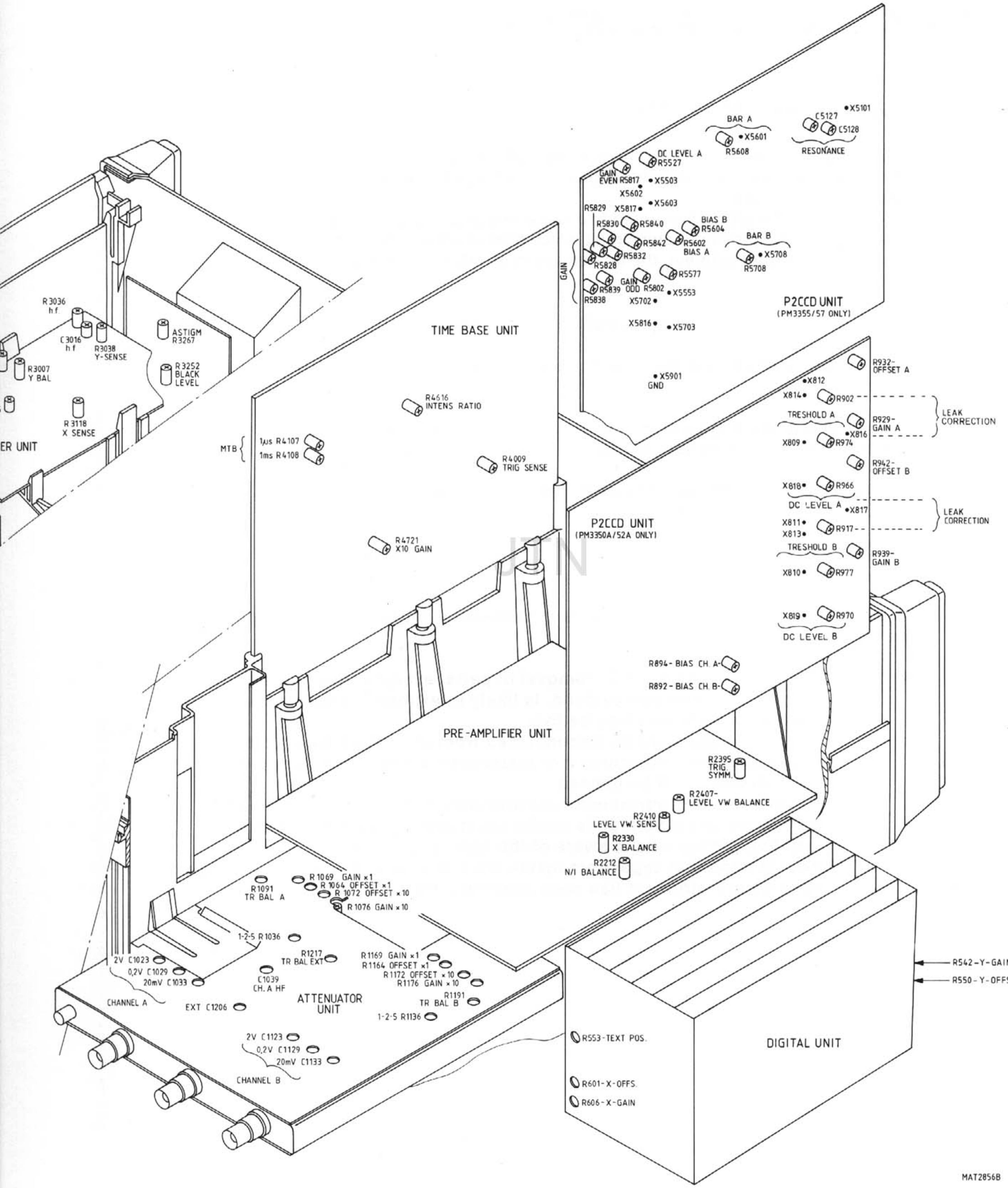


Figure 22.1 Adjusting elements

22.2 RECOMMENDED TEST AND CALIBRATION EQUIPMENT

Type of instrument	Required specification	Example of recommended instrument
Function generator	Freq.: 1 MHz ... 10 MHz Sine-wave/Square-wave Ampl.0...20 Vpp DC offset 0...± 5 V Rise-time ≤ 30 ns Duty cycle 50 %	Philips PM5134
Constant amplitude sine-wave generator	Freq.: 100 kHz ... 50 MHz Const. ampl. of 120 mVpp and 3 Vpp	Tektronix SG 503
Square-wave calibration generator	For ampl. calibration: Freq.: 1 kHz Ampl.: 10 mV ... 50 V For rise-time measurements: Freq.: 1 MHz Ampl.: 10 mV ... 500 mV Rise-time: ≤ 1 ns	Tektronox PG 506
Time-marker generator	Repetition rate: 0,5 s ... 0,05 μs	Tektronix TG 501
Digital multimeter	Wide voltage, current and resistance ranges.High-voltage probe required, accuracy 0,1% PM9246	Philips PM2524
Oscilloscope	The bandwidth must be the same or higher than the bandwidth of the instrument under test.	Philips PM3055
Variable mains tranformer	Well-insulated output voltage 90...264 Vac	Philips ord.number 2422 529 00005
Moving-iron meter		
Dummy probe 2:1	1 MΩ ± 0,1 %//20 pF	
Cables, T-piece, 10:1 attenuator, terminations for the generators	General Radio types for fast rise-time square-wave and high freq. sine-wave. BNC-types for other applications	
Trimming tool kit		Philips 800NTX (ordering number 4822 310 50015)

22.3 SURVEY OF ADJUSTING ELEMENTS

Adjustment	Adjusting element(s)	Unit	Signal type, Generator, menu	Requirement
POWER SUPPLY (see section 22.4.2)				
+10 V supply	R6406 X6001	power supply	digital voltm.	10 V (± 10 mV)
CRT DISPLAY (see section 22.4.3)				
pre adjustment	R4616	time base	--	mid position
black level line parr.	R3252	CRT socket	--	INTENS 10° from c.c.w. spot just not visible
TRACE ROTATION	front	--	--	graticule
Astigmatism	R3267	CRT socket	function generator 1 kHz/6 div. sine wave	well defined trace
GAIN, LF S.Q. WAVE (see sections 22.4.4 and 22.4.5)				
EXT input	C1206	atten. unit	calibrated sq. wave: 0,5 V/ 1 kHz	dots at beginning and end of line
	R3118	XYZ ampl.	calibrated sq. wave: 0,5 V/ 1 kHz	5 div. horizontal
A input	R1069	atten. unit	calibrated sq. wave: 0,1 mV/ 1 kHz	5 div. vertical at A sens. 20 mV/div.
	C1033	atten. unit	calibrated sq. wave: 0,1 V/ 1 kHz	Straight pulse top at A sens. 20 mV/div
	R3038	XYZ ampl.	calibrated sq. wave: 0,1 mV/ 1 kHz	5 div. vertical at A sens. 20 mV/div.
	R1076	atten. unit	calibrated sq. wave: 10 mV/ 1 kHz	5 div. vertical at A sens 2 mV/div.
	C1029	atten. unit	calibrated sq. wave: 1 V/ 1 kHz	Straight pulse top at A sens. 0,2 V/div.
	C1023	atten. unit	calibrated sq. wave: 10 V/ 1 kHz	Straight pulse top at A sens. 2 V/div.

Adjustment	Adjusting element(s)	Unit	Signal type, Generator, menu	Requirement
B input	C1133	atten. unit	calibrated sq. wave: 0,1 V/ 1 kHz	Straight pulse top at B sens. 20 mV/div.
	R1169	atten. unit	calibrated sq. wave: 0,1 V/ 1 kHz	5 div. vertical at B sens 20 mV/div.
	R1176	atten. unit	calibrated sq. wave: 10 mV/ 1 kHz	5 div. vertical at B sens 2 mV/div.
	C1129	atten. unit	calibrated sq. wave: 1 V/ 1 kHz	Straight pulse top at A sens. 0,2 V/div.
	C1132	atten. unit	calibrated sq. wave: 10 V/ 1 kHz	Straight pulse top at A sens. 2 V/div.
OFFSET (see section 22.4.6)				
1-2-5 bal. A	R1036	atten. unit	serv.menu: 3.0	minimise jump
1-2-5 bal. B	R1136	atten. unit	serv.menu: 3.0	minimise jump
VAR balance A	R1064	atten. unit	serv.menu: 3.1	Turn VAR jump
VAR balance B	R1164	atten. unit	serv.menu: 3.1	Turn VAR jump
1-10 balance A	R1072	atten. unit	serv.menu: 3.2	VAR CAL jump
1-10 balance B	R1172	atten. unit	serv.menu: 3.2	VAR CAL jump
Trig.bal. A	R1091	atten. unit	serv.menu: 3.3	VAR CAL jump
Trig.bal. B	R1191	atten. unit	serv.menu: 3.4	VAR CAL jump
Trig.bal. EXT	R1217	atten. unit	serv.menu: 3.5	VAR CAL jump
Norm.Inv. bal.	R2212	preamplifier	serv.menu: 3.6	VAR CAL jump
Final Y ampl.	R3007	XYZ-ampl.	serv.menu: 3.7	Minimise jump with LEVEL. Centre line with R3007
TRIGGERING (see section 22.4.7)				
trigg.symmetry	R2395	preamplifier	sine-wave to A	max. symmetry
trigger gap	R4004	time base	4 V/1 kHz	min. gap
trigg.symmetry	R2395	preamplifier	sine-wave to A	max. symmetry
trigger gap	R4004	time base	0,4 V/1 kHz	min. gap
LEVEL preset	R2410	preamplifier	sine-wave to A 8 V/1 kHz	LEVEL pos. such that does not move when turning R2410

Adjustment	Adjusting element(s)	Unit	Signal type, Generator, menu	Requirement
LEVEL VIEW balance	R2407	preamplifier	sine-wave to A 8 V/1 kHz	min. jump between LEVEL VIEW on/off.
LEVEL VIEW sensitivity	R2410	preamplifier	sine-wave to A 8 V/1 kHz	LEVEL 3 div. up or down. Min. jump between LEVEL VIEW on/off
TIME BASE (see section 22.4.8)				
sweep speed: 1 ms/div.	R4108	time base	time markers: 1 ms	max. accuracy between 2nd and 10th graticule line
1 μs/div.	R4107	time base	1 μs	max. accuracy between 2nd and 10th graticule line
X MAGN and 0,1 ms/div.	R4721	time base	0,1 μs	max. accuracy between 2nd and 10th graticule line
HF SQ. WAVE (see section 22.4.9)				
cross talk A,B	R3017	XYZ-ampl.	fast-rise sq. wave: 100 mV/ 10 kHz	minimal cross-talk
pulse response A (B)	R3013	XYZ-ampl.	100 mV/ 1 MHz	A sens: 20 mV/div.
	C3007	XYZ-ampl.	100 mV/ 1 MHz	Optimal pulse response
	R3017	XYZ-ampl.	100 mV/ 1 MHz	
	C3004	XYZ-ampl.	100 mV/ 1 MHz	A sens: 20 mV/div.
	C3005	XYZ-ampl.	100 mV/ 1 MHz	Optimal pulse response
	C3016	XYZ-ampl.	100 mV/ 1 MHz	X MAGN on
	R3036	XYZ-ampl.	100 mV/ 1 MHz	

Adjustment	Adjusting element(s)	Unit	Signal type, Generator, menu	Requirement
Pulse response channel A	C1039	attenuator unit	100 mV/1 MHz	Make channel A equal to B
P^2CCD ADJUST (see section 22.4.10) PM3350A/52A only				DIGITAL MEMORY
Treshold A	R974, X809	P^2CCD unit	digital voltm.	6 V d.c
Treshold B	R977, X810	P^2CCD unit	digital voltm.	6 V d.c
Bias charge A	R894	P^2CCD unit	digital voltm.	43,3 V
Bias charge B	R892	P^2CCD unit	digital voltm.	43,3 V
Signal DC level A	R966, X811 X812	P^2CCD unit	measuring oscilloscope	300 mV d.c.
Signal DC level B	R970, X813 X814	P^2CCD unit	measuring oscilloscope	300 mV d.c.
Leakage corr. A	R902, X816	P^2CCD unit	measuring oscilloscope	line
Leakage corr. B	R917, X817	P^2CCD unit	measuring oscilloscope	line
P^2CCD ADJUST (see section 22.4.11) PM3355/57 only				DIGITAL MEMORY
Oscillator	C5127, 5128	P^2CCD unit	measuring	min. signal
Treshold A	R5608, X5601	P^2CCD unit	digital voltm.	6 V d.c.
	R5527, X5503	P^2CCD unit	digital voltm.	7 V d.c.
Treshold B	R5708, X5701	P^2CCD unit	digital voltm.	6 V d.c.
	R5577, X5553	P^2CCD unit	digital voltm.	7 V d.c.
Bias charge A	R5604 X5602/03	P^2CCD unit	measuring oscilloscope	300 mV d.c.
Bias charge B	R5602 X5702/03	P^2CCD unit	measuring oscilloscope	300 mV d.c.
Leakage corr. A	R5802, X5816	P^2CCD unit	measuring oscilloscope	line
Leakage corr. B	R5817, X5817	P^2CCD unit	measuring oscilloscope	line

Adjustment	Adjusting element(s)	Unit	Signal type, Generator, menu	Requirement
DISPLAY SECTION (see section 22.4.12)			service menu DISPLAY	DIGITAL MEMORY on
Y-offset	R550	digital unit	step 1	display vertical mid
Y-gain	R542	digital unit	step 2	6 div. vertical
X-offset	R601	digital unit	step 3	display horizontal mid
X-gain	R606	digital unit	step 4	10 div. horizontal
Text position	R553	digital unit	step 5	text in horizontal mid
GAIN - OFFSET (see section 22.4.13) PM3350A/52A only				
Offset A	R932	P^2CCD unit	--	Position 2,5 divisions downwards with DIGITAL MEMORY on
Gain A	R929	P^2CCD unit	calibrated sq. wave: 100 mV/ 1 kHz	A sens.: 20 mV/div 5 div. deflection
Offset A	R932	P^2CCD unit	--	Position vertical mid with DIGITAL MEMORY on
Offset B	R942	P^2CCD unit	--	Position 2,5 divisions downwards with DIGITAL MEMORY on
Gain B	R939	P^2CCDunit	calibrated sq. wave: 100 mV/ 1 kHz	B sens.: 20 mV/div 5 div. deflection
Offset B	R942	P^2CCD unit	--	Position vertical mid with DIGITAL MEMORY on
GAIN - OFFSET (see section 22.4.14) PM3355/57 only				
Offset A 200 μs	R5832	P^2CCD unit	--	Position 2,5 divisions downwards with DIGITAL MEMORY on
Gain A 200 μs	R5829	P^2CCD unit	calibrated sq. wave: 100 mV/ 1 kHz	A sens.: 20 mV/div 5 div. deflection
Offset A 200 μs	R5832	P^2CCD unit	--	Position vertical mid with DIGITAL MEMORY on

Adjustment	Adjusting element(s)	Unit	Signal type, Generator, menu	Requirement
Offset B 200 μs	R5842	P^2CCD unit	--	Position 2,5 divisions downwards with DIGITAL MEMORY on
Gain B 200 μs	R5839	P^2CCDunit	calibrated sq. wave: 100 mV/ 1 kHz	B sens.: 20 mV/div 5 div. deflection
Offset B 200 μs	R5842	P^2CCD unit	--	Position vertical mid with DIGITAL MEMORY on
Offset A 200 ns	R5830	P^2CCD unit	--	Position 2,5 divisions downwards with DIGITAL MEMORY on.
Gain A 200 ns	R5828	P^2CCD unit	calibrated sq. wave: 100 mV/ 1 MHz	A sens.: 20 mV/div 5 div. deflection
Offset A 200 ns	R5830	P^2CCD unit	--	Position vertical mid with DIGITAL MEMORU on.
Offset B 200 ns	R 5840	P^2CCD unit	--	Position 2,5 divisions downwards with DIGITAL MEMORY on.
GAIN B 200 ns	R5838	P^2CCD unit	calibrated sq. wave: 100 mV 1 MHz	B sens.: 20 mV/div 5 div. deflection
Offset B 200 ns	R5840	P^2CCD unit	--	Position vertical mid with DIGITAL MEMORY on.

22.4 CHECKING AND ADJUSTING PROCEDURE

The adjusting elements and measuring points are given in figure 22.1.

NOTE: Use always an insulated adjustment tool.

22.4.1 Preparation

Before starting the checking and adjusting procedure, it is necessary to be aware of the following.

- Unless otherwise indicated, the time base must be triggered on the channel that is selected for vertical display and the trigger path is P-P coupled. The time base must function in the AUTO mode and its sweep speed must be adjusted to give good display of the phenomena of interest. The INTENS and FOCUS control must be adjusted to a well- defined trace display.
- Preliminary setting of the controls:
  All VAR controls must be set in CAL position
  All POS and LEVEL controls must be set in mid-position.
  The HOLD OFF control must be set to MIN position.
- Take care to remove the input voltage after each section.
- All signal values are peak-to-peak values (pk-pk), unless otherwise indicated.

For better access to the adjusting elements on the time base unit and the power supply unit, proceed as indicated in section 21.3.

ATTENTION: Do not readjust potentiometer R2395, situated on the Pre-amplifier unit. However, if this potentiometer is inadvertently turned, proceed as follows:
- Set R2395 in its mid-position.
- Readjust R4009 according to section 22.4.7.

22.4.2 Power supply adjustment

Adjustment on power supply unit A6.

- Connect the instrument to the mains voltage and switch on the oscilloscope.
- Connect a digital multimeter to connection point X6001 (+10V REF) on the power supply unit and the instrument's ground.
- Adjust R6406 so that the supply voltage is exactly +10 V (tolerance: +or- 0,01 V).

22.4.3 CRT display adjustment

Black level:
- Press X DEFL key.
- Set the INTENS control to 10° from its left hand stop.
- Set R4616 in its mid position.
- Adjust R3252 so that the spot is just not visible.

Trace rotation:
- Press X DEFL key again for deflection via MTB.
- Adjust the front-panel TRACE ROTATION control so that the trace runs exactly in parallel with the horizontal graticule lines.

Astigmatism:
- Apply a 120 mV/1 kHz sine-wave signal to input A.
- Press AUTO SET key.
- Set the INTENS control for normal brightness.
- Adjust R3267 (and the FOCUS control) so that the trace is sharp and well-defined over the whole screen area.

22.4.4 Gain and LF-sq.wave response EXT and A input

Adjustments on attenuator unit A1, unless otherwise indicated.

Input EXT:
- Press MENU and then AUTO SET in sequence in order to reach the default setting.
- Press X DEFL.
- Select TRIG SOURCE "EXT".
- Select TRIG COUPL "DC".
- EXT input signal: calibrated sq.wave 0,5 V/1 kHz.
- Adjust C1206 for equal dots at beginning and end of horizontal line.
- Adjust R3118 on XYZ-amplifier for 5 div. horizontal deflection (+ or -0,1 div.).

Input A:
- Select TRIG SOURCE "B".
- A input signal: calibrated sq.wave 100 mV/1 kHz.
- Channel A sensitivity: 20 mV/div.
- Adjust R1069 for 5 div. vertical deflection (+ or - 0,1 div.).
- Remove the input signal.

22.4.5 Gain and LF-sq.wave response channel A(B)

Adjustments are located on attenuator unit A1, except R3038 that is located on XYZ-amplifier A3.

- Do the adjustments for channel A first. Then those mentioned between brackets for channel B.
- Press MENU and then AUTO SET in sequence in order to reach the default setting.
- Select TRIG SOURCE "A(B)".
- Adjust vertical gain to 5 div. (+ or - 0,1 div.) and pulse top as straight as possible (max. distortion + or - 0,075 div.). Use a calibrated sq.wave signal.

Input signal channel A(B)	Input sensitivity channel A(B)	Adjusting elements sq.wave resp.	Adjusting elements gain
0,1 V	20 mV/div.	C1033 (C1133)	R3038 (R1169)
10 mV	2 mV/div.	--	R1076 (R1176)
1 V	0,2 V/div.	C1029 (C1129)	--
10 V	2 V/div.	C1023 (C1123)	--

22.4.6 Offset channel A(B)

Service menu:

- Y POS A (B) controls: mid-position.
- Press MENU and keep it pressed. Then press AUTO SET in order to reach the service menu.
- Press CRT-softkey OFFS-A.
- The successive steps in the following adjustment procedure must be selected with the channel A UP-DOWN control for the input sensitivities.
- The adjustments are located on the attenutor unit; unless otherwise noted in last column of table.

Adjustment step	Adjustment point	Max instab.	
3.0 1-2-5 balance A(B)	R1036 (R1136)	0,1 div.	
3.1 VAR-balance A(B)	R1064 (R1164)	0,2 div.	Turn VAR A(B)
3.2 1-10 balance A(B)	R1072 (R1172)	0,2 div.	VAR A(B) in CAL
3.3 Trig. balance A	R1091	0,3 div.	
3.4 Trig. balance B	R1191	0,3 div.	
3.5 Trig. balance EXT	R1217	0,3 div.	
3.6 Norm/Inv. bal. B	R2212	0,1 div.	on pre amplifier
3.7 Y bal.	R3007	0,2 div.	on pre amplifier Minimise jump with TRIG LEVEL. Centre line with R3007.

- Press AUTO SET twice to leave the service menu.

22.4.7 Triggering

Adjustments on pre-amplifier A2 unless otherwise noted.

- Press MENU and then AUTO SET in sequence in order to reach the default setting.
- Channel A input signal: 0,4 V/1 kHz sine-wave.
- TRIGGER LEVEL: mid position.
- Trigger slope pushbutton must be continuously switched.
- Adjust R4004 (time base) for a well triggered display.

- Channel A input signal: 8 V/1 kHz sine-wave.
- Select TRIGGER COUPL "DC".
- Press LEVEL VIEW.
- Put TRIG LEVEL in such a position that line does not move when turning R2410 between its utmost positions. Keep TRIG LEVEL in this position.

- Switch LEVEL VIEW off.
- Time base sweep speed: 50 ns/div.
- INTENS control: fully clockwise.
- Adjust R2407 for minimal trace jump (+ or - 0,4 div. max) when switching LEVEL VIEW on and off.

- Switch LEVEL VIEW on.
- Shift the line with TRIG LEVEL 3 div. upwards or downwards from its present situation (within graticule).
- Adjust R2410 for minimal trace jump (+ or - 0,2 div. max) when switching LEVEL VIEW on and off.
- Remove the input signal.

22.4.8 Time-base sweep speeds

Adjustments on time-base unit A4.

- Press MENU and then AUTO SET in sequence in order to reach the default setting.
- Select TRIG COUPL "DC".
- Channel A input signal: time marker pulse 1 ms.
- Adjust Y POS A, TRIG LEVEL and channel A input sensitivity for a well-readable display.
- Adjust R4108 so that 2nd and 10th marker pulse coincide with the corresponding graticule lines (max. deviation 0,16 div.). Use X POS for a correct horizontal position.

- Channel A input signal: time marker pulse 1 μs.
- Time base sweep speed: 1 μs/div.
- Adjust R4107 so that 2nd and 10th marker pulse coincide with corresponding graticule lines. Max. deviation 0,16 div.

- Channel A input signal: time marker pulse 0,1 ms.
- Press X MAGN.
- Time base sweep speed: 0,1 ms/div.
- Adjust R4721 so that 2nd and 10th marker pulse coincide with corresponding graticule lines. Use X POS for a correct horizontal position; the control must stay approximately in its mid position. Max. deviation 0,24 div.
- Turn X POS fully clockwise and fully counter clockwise and check that the marker pulse deviation does not exceed 0,24 div.
- Remove the input signal.

22.4.9 HF sq.wave response

Adjustments on XYZ-amplifier A3.

- Press MENU and then AUTO SET in sequence in order to reach the default setting.
- Channel A input signal: fast rise time sq.wave 10 kHz/100 mV/rise time $\leq$ 1 ns via external 10:1 attenuator and 50 ohm termination resistor.
- Select channel A and B for vertical display.
- Press ALT/CHOP for a chopped display.
- Channel A and B input sensitivity: 10 mV/div.
- Time base sweep speed: 50 μs/div.
- Adjust R3017 for minimal cross-talk from channel A into B (max. interference on B 0,05 div.).

- Select channel B for vertical display and TRIGGER SOURCE.
- Channel B input signal: increase frequency to 1 MHz. Adjust the generator's output voltage for 5 div. vertical deflection.
- Channel B input sensitivity: 20 mV/div.

- Adjust R3013 and C3007 for a pulse top as flat as possible. Also small readjustment of R3017 may be necessary: however bear in mind that R3017 also influences the crosstalk.

- Press X MAGN for *10.
- Adjust C3004, C3005, C3016 and R3036 for a pulse top as flat as possible.

- Select channel A for vertical display and TRIGGER SOURCE.
- Channel A input signal: frequency = 1 MHz. Generator's output voltage is set for 5 div. vertical deflection.
- Channel A input sensitivity: 20 mV/div.
- Press X MAGN for *1.

- **Make the pulse response of channel A as much as possible equal to that of channel B with C1039 on the attenuator unit.**

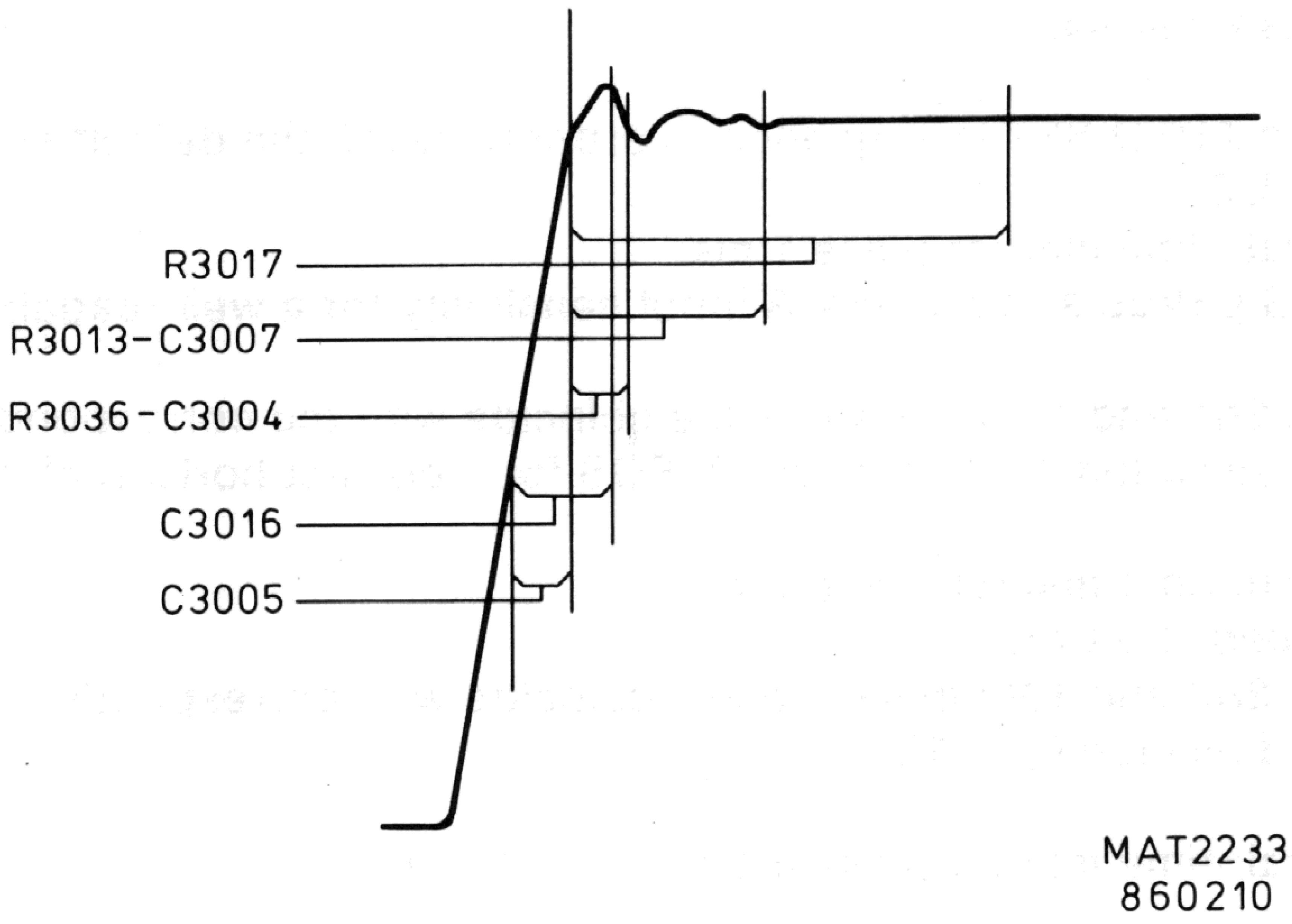


Figure 22.2 Square-wave response

- **Check that the pulse via channel A has a rise-time of ≤ 7 ns and that pulse abberations are ≤ 0,2 div. peak-to-peak. Tilt must not exceed + or - 0,1 div.**

22.4.10 P²CCD-adjustment - PM3350A/52A only

Adjustments located on P²CCD-unit A18 in PM3350A/52A.

Treshold A (B):
- **Press MENU and then AUTO SET in sequence in order to reach the default setting.**
- **Select channel A and B for vertical display.**
- **Set A and B line in centre of screen by means of A POS and B POS.**
  Y POS A and B: must stay in mid position during adjustment in this chapter.
- **Switch DIGITAL MEMORY on.**
- **Adjust the d.c. voltage between measuring point X809 (X810) and X821 (=earth) to 6 V (+ or - 100 mV) with R974 (R977).**

Bias charge A (B):
- **Adjust the d.c. voltage between connector point 2 of A17 of ch. A (ch. B) and X821 (=earth) to 43,3 V (+ or - 0,1 V) with R894 (R892).**

Linearity A (B):

- Press MENU and then AUTO SETin sequence in order to reach the default setting..
- Select channel A and B for vertical display.
- Switch DIGITAL MEMORY on.
- Channel A and B sensitivity: 0,1 V/div.
- Connect a measuring oscilloscope with a.c. coupled input to measuring point X812 (X814) and X821 (=earth).
  Measuring oscilloscope: 200 mV/div - 1 ms/div.
- Channel A (B) input coupling: GND.
- Adjust R966 (R970) so that the the voltage "V" between the measuring points X811-X812 (X813-X814) and X821 (=earth) is 300 mV (+ or - 30 mV). Refer to figure 22.3. The values of X811-X812 (X813-X814) must be averaged to the 300 mV.
- Channel A (B) input signal: triangular 1 V/1 kHz.
- Switch GND off for A(B).
- Channel A (B) input coupling: DC.
- Check with the measuring oscilloscope that the triangular voltage is visible in the bottom level of the measured signal.
- Disconnect the input signal.

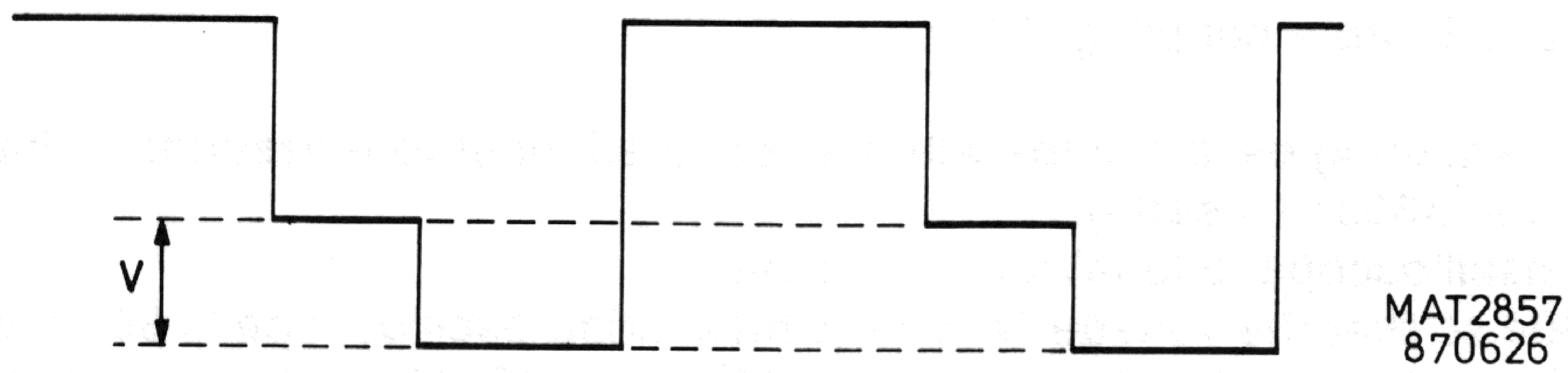


Figure 22.3 Adjustment of ΔV = 300 mV

Leakage correction:

- Channel A (B) input signal: square wave 800 mV/1 kHz.
- Time-base speed: 200 μs/div.
- Connect a measuring oscilloscope with a.c. coupled input to measuring point X816 (X817) and X821 (=earth).
- Adjust R902 (R917) so that the square wave signal has become a line.
- Remove input signal.
- Remove the measuring oscilloscope.

22.4.11 P²CCD-adjustment - PM3355/57 only

Adjustments located on P²CCD unit A18 in PM3355/57.

Oscillator:

- Press MENU and AUTO SET in sequence in order to reach the default setting.
- Switch DIGITAL MEMORY on.
- Connect a measuring oscilloscope with d.c. coupled input to measuring point X5101 and X5901 (=earth).
- Time base speed: 0,2 μs/div.
- Adjust C5127 so that the d.c.-value on the measuring oscilloscope is as small as possible.
- Time base speed: 0,5 μs/div.
- Adjust C5128 so that the d.c.-value on the measuring oscilloscope is as small as possible.
- Repeat the adjustments of C5127 and C5128 a couple of times since they are interdependent.
- Remove the measuring oscilloscope.

Treshold A (B):

- Switch DIGITAL MEMORY off.
- Select channel A and B for vertical display.
- Set A and B line in centre of screen by means of A POS and B POS .
  A POS and B POS: must stay in mid-position during the adjustments in this chapter.
- Switch DIGITAL MEMORY on.
- Time base speed: 10 μs/div.
- Adjust the d.c. voltage between measuring point X5601 (X5701) and X5901 (=earth) to 6 V (+or- 100 mV) with R5608 (R5708).
- Adjust the d.c. voltage between measuring point X5503 (X5553) and X5901 (=earth) to 7 V (+or- 100 mV) with R5527 (R5577).

Bias charge A and B:
- Press MENU and then AUTO SET in sequence in order to reach the default setting.
- Select channel A and B for vertical display.
- Switch DIGITAL MEMORY on.
- Channel A and B sensitivity: 0,1 V/div.
- Time base speed: 10 μs/div.
- Channel A and B input coupling: GND.

- Connect a measuring oscilloscope with a.c. coupled input to measuring point X5602 (or X5603) and X5901 (=earth).
  Measuring oscilloscope: 200 mV/div - 1 ms/div.
- Adjust R5604 so that the voltage "V" on the measuring oscilloscope is 300 mV (+or-30 mV). Refer to figure 22.4. The values of X5602 and X5603 must be averaged to the 300 mV.
- Channel A input signal: triangular 1 V/1 kHz.
- Switch GND off.
- Channel A input coupling: DC.
- Check with the measuring oscilloscope that the triangular voltage is visible in the bottom level of the measured signal.
- Disconnect the input signal.
- Remove the measuring oscilloscope.

- Connect a measuring oscilloscope with a.c. coupled input to measuring point X5702 (or X5703) and X5901 (=earth).
  Measuring oscilloscope: 200 mV/div - 1 ms/div.
- Adjust R5602 so that the voltage "V" on the measuring oscilloscope is 300 mV (+or-30 mV). Refer to figure 22.4. The values of X5602 and X5603 must be averaged to the 300 mV.
- Channel B input signal: triangular 1 V/1 kHz.
- Switch GND off.
- Channel B input coupling: DC.
- Check with the measuring oscilloscope that the triangular voltage is visible in the bottom level of the measured signal.
- Disconnect the input signal.
- Remove the measuring oscilloscope.

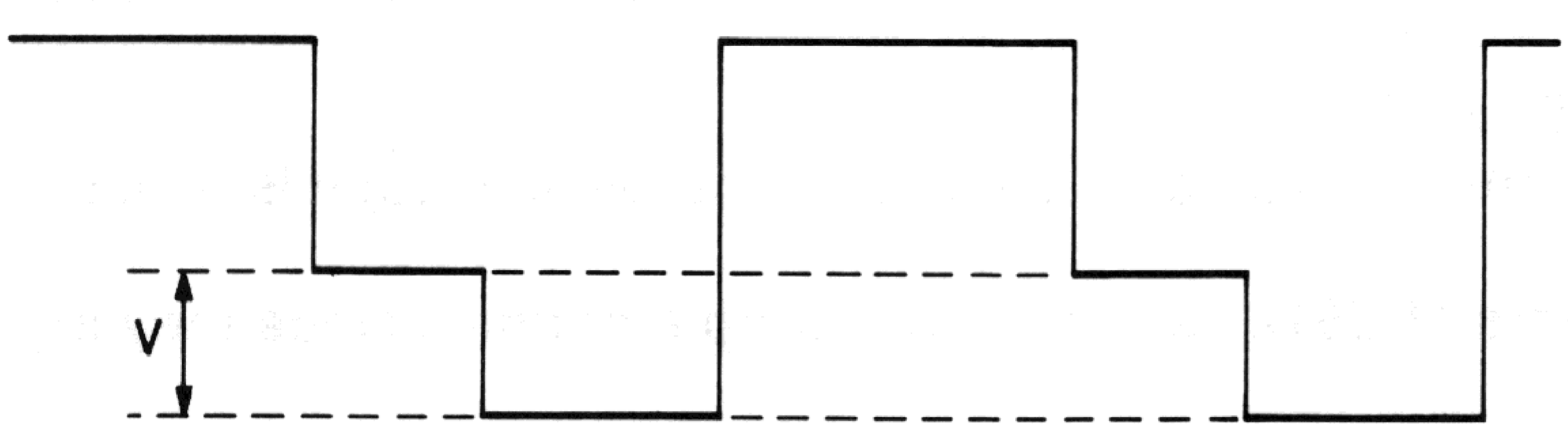


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Figure 22.4 Adjustment of ΔV = 300 mV

Leakage correction:

- Channel A (B) input signal: square wave 800 mV/1 kHz.
- Time base speed: 200 μs/div.
- Connect a measuring oscilloscope with a.c. coupled input to measuring point X5816 (X5817) and X5901 (=earth).
  Measuring oscilloscope: 100 mV/div - 1 ms/div.
- Adjust R5802 (R5817) so that the square wave signal has become a line.
- Remove the input signal.
- Remove the measuring oscilloscope.

22.4.12 Display section adjustments

All adjustments are located on the digital unit A15 or A16.

DAC and text adjustments:

- Press MENU and then AUTO SET is sequence in order to reach the default setting..
- Adjust X POS so that trace starts at first vertical graticule line.
- Press MENU and AUTO SET together in order to reach the Service menu.
- Press CRT softkey DISPLAY.
  The CRT now shows the picture as given in figure 22.5.
- Adjust INTENS and FOCUS for a good display.

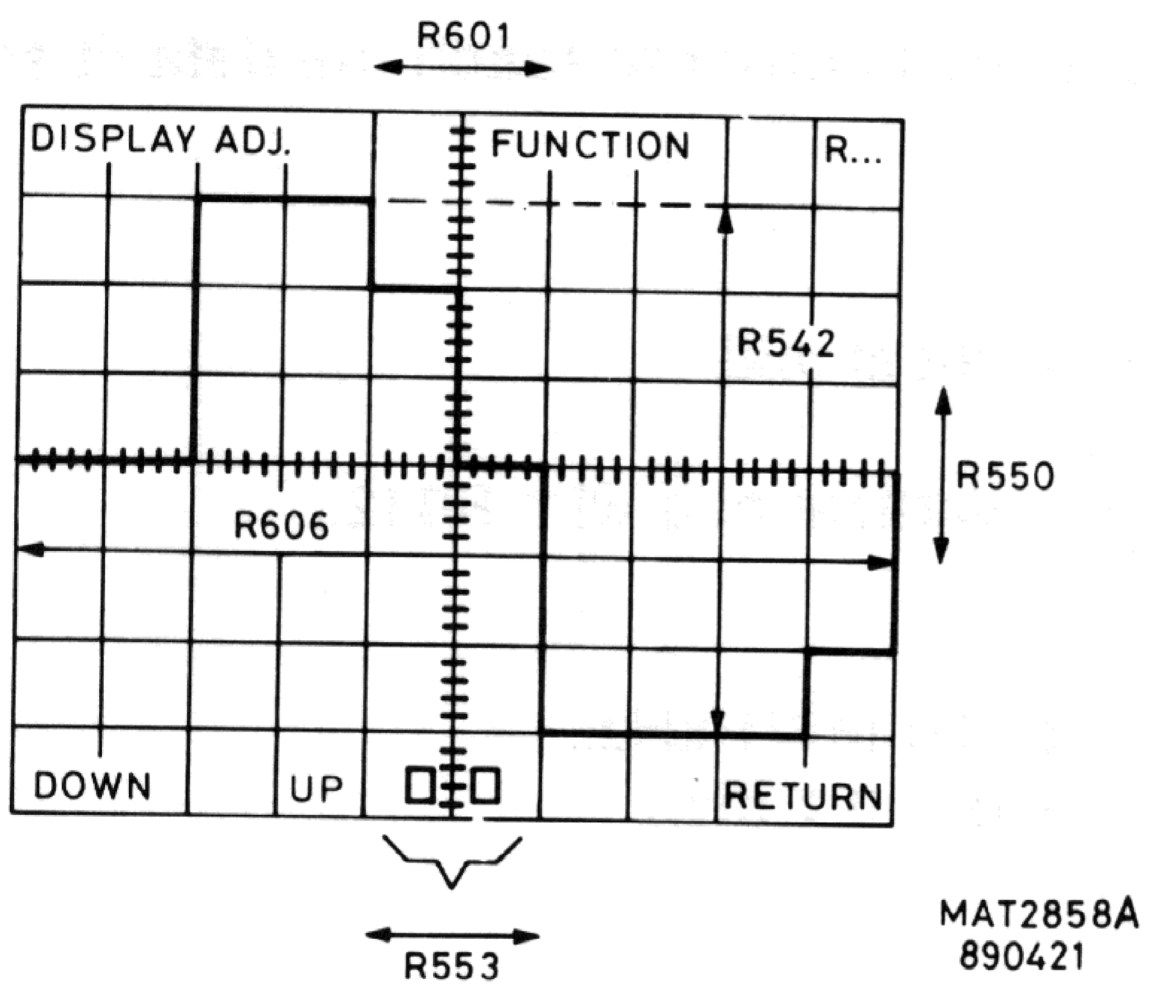


Figure 22.5 DAC and text adjustments

- Do the adjustments steps describe in the table:

Step	Adjustment	Requirement
1	R550, Y-offset	display in vertical mid (+ or - 0,07 div.)
2	R542, Y-gain	6 div. pk-to-pk, + or - 0,07 div.
3	R601, X-offset	display horizontal mid (+ or - 0,2 div.)
4	R606, X-gain	10 div. pk-to-pk, + or - 0,12 div.
5	R553, text pos.	text in horizontal mid, + or - 0,2 div.

- Press AUTO SET twice to leave the service menu.

22.4.13 Gain and offset channel A (B) - PM3350A/52A only

All adjustments located on P^2CCD-unit A18 in PM3350A/52A.

For channel A:
- Press MENU and then AUTO SET in sequence in order to reach the default setting.
- Channel A sensitivity: 20 mV/div.
- Channel A coupling: GND.
- Adjust Y POS A 2,5 div. downwards from vertical mid.
- Switch DIGITAL MEMORY on.
- Position the trace 2,5 div. downwards from vertical mid with R932.

- Channel A coupling: switch GND off.
- Channel A input signal: calibrated sq.wave 100 mV/1 kHz.
- Adjust R929 to 5 div. vertical deflection (+ or - 0,1 div.).
- Channel A coupling: GND.
- Switch DIGITAL MEMORY off.
- Position the trace in vertical mid with Y POS A.
- Switch DIGITAL MEMORY on.
- Position the trace in vertical mid of screen with R932 (+ or - 0,2 div.).
- Remove input signal.

For channel B:
- Press MENU and then AUTO SET in sequence in order to reach the default setting.
- Vertical display and TRIG SOURCE: B.
- Channel B sensitivity: 20 mV/div.
- Channel B coupling: GND.
- Adjust Y POS B 2,5 div. downwards from vertical mid.
- Switch DIGITAL MEMORY on.
- Position the trace 2,5 div. downwards from vertical mid with R942.

- Channel B coupling: switch GND off.
- Channel B input signal: calibrated sq.wave 100 mV/1 kHz.
- Adjust R939 to 5 div. vertical deflection (+ or - 0,1 div.).
- Channel B coupling: GND.
- Switch DIGITAL MEMORY off.
- Position the trace in vertical mid with Y POS B.
- Switch DIGITAL MEMORY on.
- Position the trace in vertical mid of screen with R942 (+ or - 0,2 div.).
- Remove the input signal.

22.4.14 Gain and offset channel A(B) - PM3355/57 only

All adjustments located on P^2CCD-unit A18 in PM3355/57

For channel A at 200 μs:
- Press MENU and AUTO SET in sequence in order to reach the default setting.
- Channel A sensitivity: 20 mV/div.
- Channel A input coupling: GND.
- Time base speed: 200 μs/div.
- Adjust Y POS A 2,5 div. downwards from vertical mid.
- Switch DIGITAL MEMORY on.
- Position the trace 2,5 div. downwards from vertical mid with R5832.

- Channel A coupling: switch GND off.
- Channel A input signal: calibrated sq. wave 100 mV/1 kHz
- Adjust R5829 to 5 div. vertical deflection (+or- 0,1 div.).
- Channel A coupling: GND.
- Switch DIGITAL MEMORY off.
- Position the trace in vertical mid with Y POS A.
- Switch DIGITAL MEMORY on.
- Position the trace in vertical mid of screen with R5832. (+or- 0,2 div.).
- Remove the input signal.

For channel B at 200 μs:
- Press MENU and AUTO SET in sequence in order to reach the default setting.
- Vertical display and TRIG SOURCE: B
- Channel B sensitivity: 20 mV/div.
- Channel B input coupling: GND.
- Time base speed: 200 μs/div.
- Adjust Y POS B 2,5 div. downwards from vertical mid.
- Switch DIGITAL MEMORY on.
- Position the trace 2,5 div. downwards from vertical mid with R5842.

- Channel B coupling: switch GND off.
- Channel B input signal: calibrated sq. wave 100 mV/1 kHz
- Adjust R5839 to 5 div. vertical deflection (+or- 0,1 div.).
- Channel B coupling: GND.
- Switch DIGITAL MEMORY off.
- Position the trace in vertical mid with Y POS B.
- Switch DIGITAL MEMORY on.
- Position the trace in vertical mid of screen with R5842. (+or- 0,2 div.).
- Remove the input signal.

For channel A at 0,2 μs:
- Press MENU and AUTO SET in sequence in order to reach the default setting.
- Channel A sensitivity: 20 mV/div.
- Channel A input coupling: GND.
- Adjust Y POS A 2,5 div. downwards from vertical mid.
- Time base speed: 0,2 μs/div.
- Switch DIGITAL MEMORY on.
- Position the trace 2,5 div. downwards from vertical mid with R5830.

- Channel A coupling: switch GND off.
- Channel A input signal: calibrated sq. wave 100 mV/1 MHz
- Adjust R5828 to 5 div. vertical deflection (+or- 0,1 div.).
- Channel A coupling: GND.
- Switch DIGITAL MEMORY off.
- Position the trace in vertical mid.
- Switch DIGITAL MEMORY on.
- Position the trace in vertical mid of screen with R5830. (+or- 0,2 div.).
- Remove the input signal.

For channel B at 0,2 μs:
- Press MENU and AUTO SET in sequence in order to reach the default setting.
- Vertical display and TRIG SOURCE: B
- Channel B sensitivity: 20 mV/div.
- Channel B input coupling: GND.
- Adjust Y POS B 2,5 div. downwards from vertical mid.
- Time base speed: 0,2 μs/div.
- Switch DIGITAL MEMORY on.
- Position the trace 2,5 div. downwards from vertical mid with R5840.

- Channel B coupling: switch GND off.
- Channel B input signal: calibrated sq. wave 100 mV/1 MHz
- Adjust R5838 to 5 div. vertical deflection (+or- 0,1 div.).
- Channel B coupling: GND.
- Switch DIGITAL MEMORY off.
- Position the trace in vertical mid.
- Switch DIGITAL MEMORY on.
- Position the trace in vertical mid of screen with R5840. (+or- 0,2 div.).
- Remove the input signal.

23 CORRECTIVE MAINTENANCE

23.1 REPLACEMENTS

WARNING: The Extremely High Tension (EHT) cable is directly connected to the CRT. When the EHT cable to the post-acceleration anode is disconnected, the cable must be discharged by shorting the terminal to the instrument's earth.

23.1.1 Standard parts

Electrical and mechanical replacement parts can be obtained through your local PHILIPS/FLUKE organisation or representative. However, many of the standard electronic components can be obtained from other local suppliers. Before purchasing or ordering replacement parts, check the parts list for value, tolerance, rating and description.

NOTE: Physical size and shape of a componenent may affect the instrument's performance, particularly at high frequencies. Always use direct-replacement components, unless it is known that a substitute will not degrade the instrument's performance.

23.1.2 Special parts

In addition to the standard electronic components, some special components are used:

- Components, manufactured or selected by PHILIPS to meet specific performance requirements.
- Components which are important for the safety of the instrument.

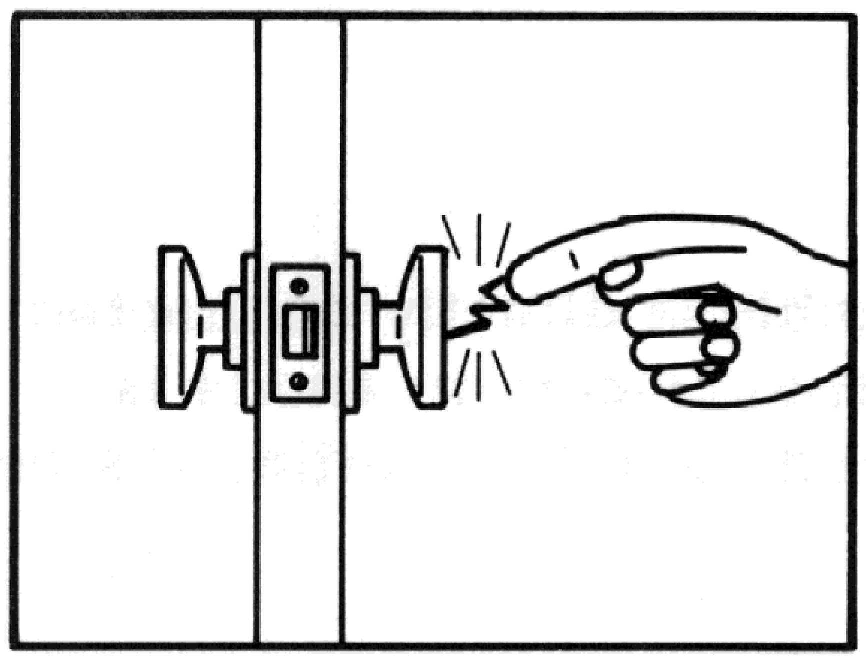
ATTENTION: Both type of components may only be replaced by components obtained through your local PHILIPS/FLUKE organisation of representative.

23.1.3 Transistors and Integrated Circuits

- Return transistors and IC's to their original positions, if removed during routine maintenance.
- Do not renew or switch semi-conductor devices unnecessarily, as it may affect the calibration of the instrument.
- Any replacement component should be of the original type or a direct replacement. Bend the leads to fit the socket or pcb-holes and cut the leads to the same length as on the component being renewed. See also the Performance test in this Service manual.
- When a device has been renewed, check the operation of the part of the instrument that may be affected.
- When re-installing power-supply transistors, use silicon grease to increase the heat-transfer capabilities.

WARNING: Handle silicon grease with care. Avoid contact with the eyes. Wash hands thoroughly after use.

23.2 STATIC SENSITIVE COMPONENTS



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23.2.1 Introduction

The instrument in which the black/yellow "static sensitive components" symbol is present, contains electrical components that can be damaged by electrostatical discharge. This symbol can be found on every printed circuit board with static sensitive components. Though e.g. all our MOS integrated circuits incorporate protection against electrostatic discharge, they nevertheless can be damaged by accidental over-voltages.

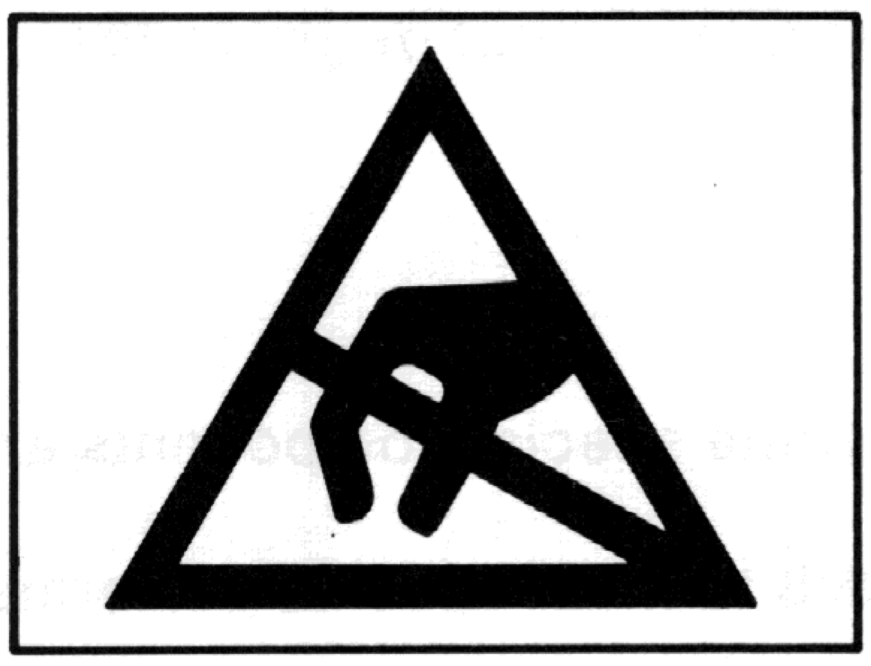

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Figure 23.1 Static sensitive symbol

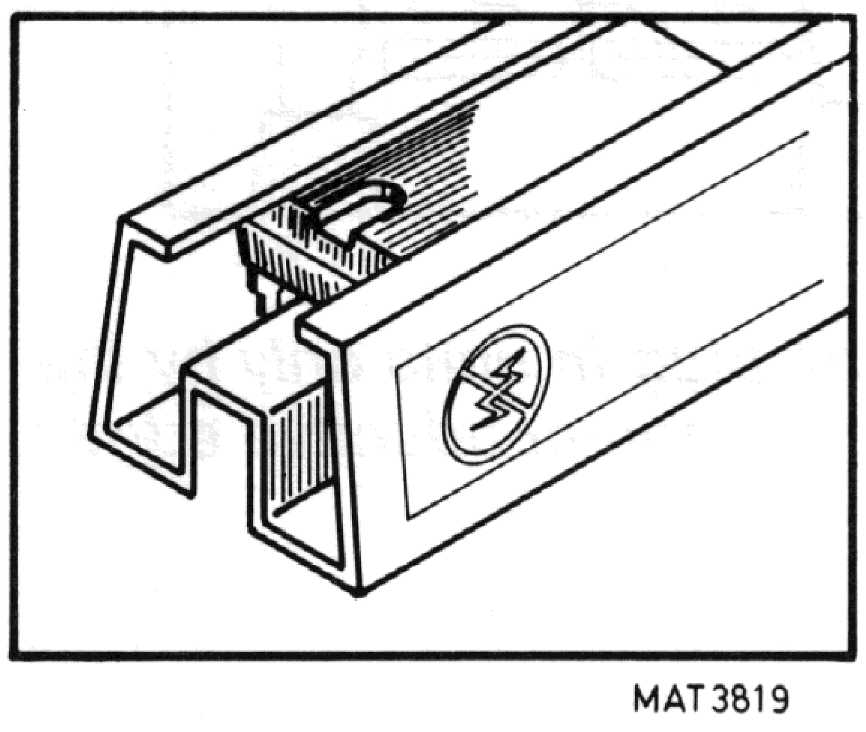
It is also possible that a delayed failure or "winding" effect may occur. When this happens the component will fail anywhere between two hours to six months later.

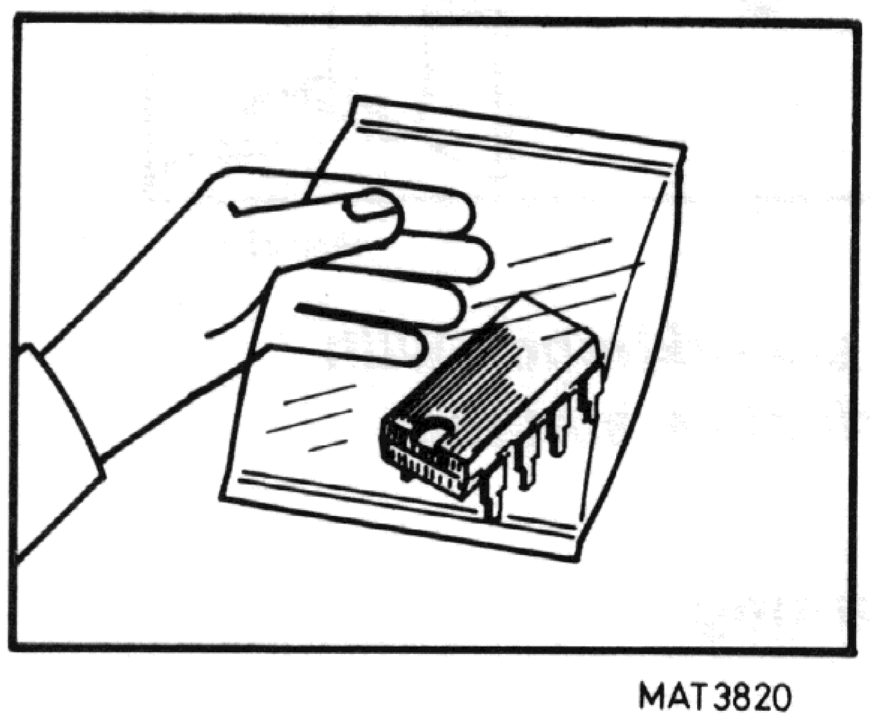
In storing and handling static sensitive components, the normal precautions for these devices are recommended. Handling and servicing static sensitive assemblies and components should be performed only at a static free workstation by qualified personnel.

CAUTION: Testing, handling and mounting call for special attention. Personnel, handling static sensitive devices, should normally be connected to ground via a high-ohmic resistor.

23.2.2 Storage And Transport

Store and transport the circuits in their original packing until required for use. Alternatively, you may make use of a conductive material or a special IC carrier that either short-circuits all leads or insulates them from external contact.

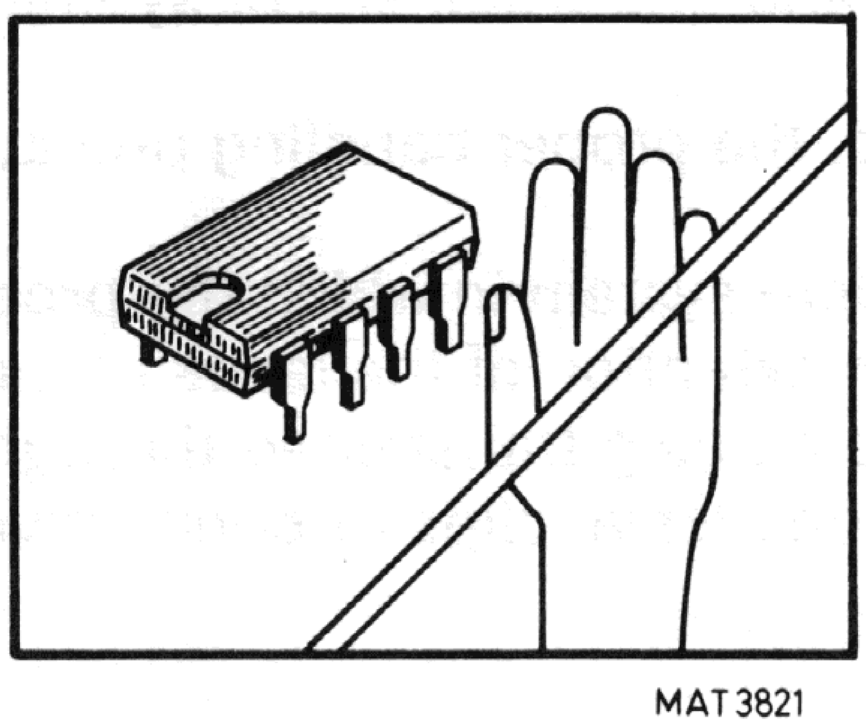




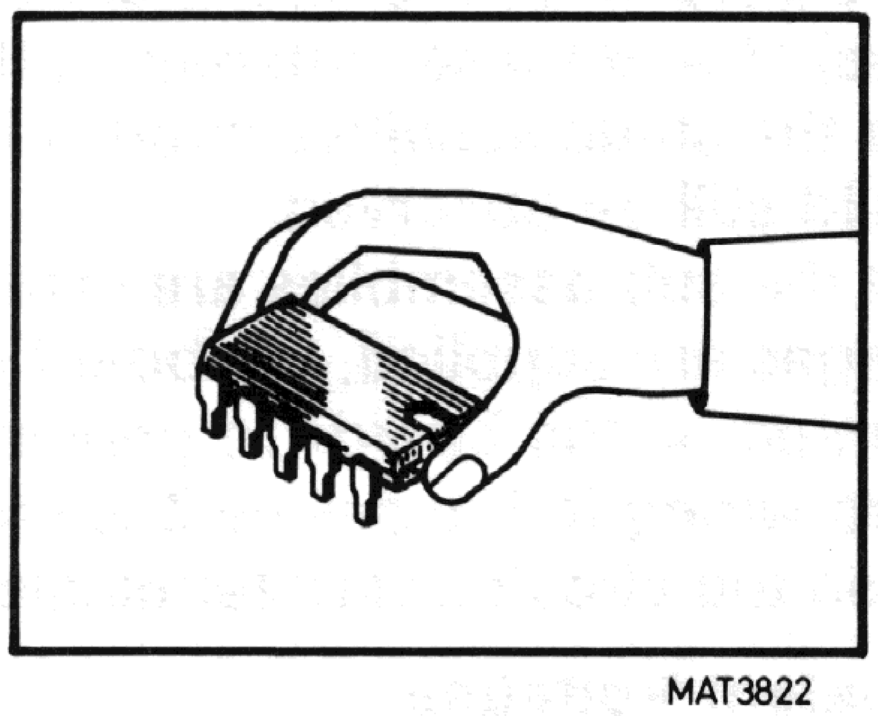
Examples of suitable anti-static packing material.

23.2.3 Testing Or Handling

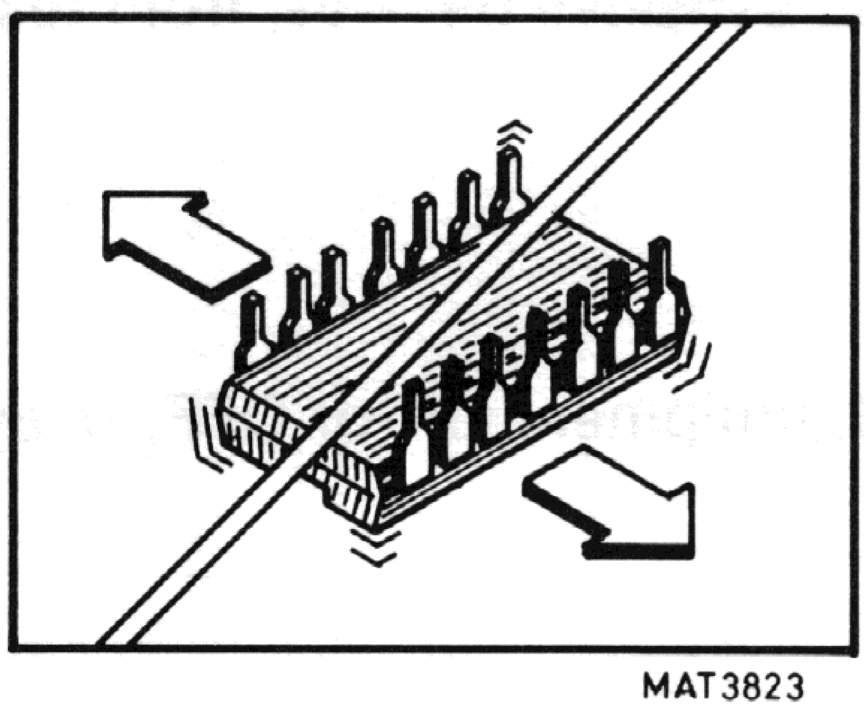
Minimise handling as much as possible and handle the devices by the body.
Do not slide the devices over any surface.
Work on a conductive surface (e.g. conductive table top) when testing the circuits or transferring them from one carrier to another. Electrically connect the person doing the testing or handling to the conductive surface, for example via a conductive bracelet and a conductive cord. Connect all testing and handling equipment to the same potential. Signals should not be applied to the same surface or the inputs while the device power supply is off. All unused input leads should be connected either to the supply voltage or to ground. When handling plug-in units, handle only by the non-conductive edges and never touch the open edge connector except at a static-free work station.
Placing shorting strips on edge connectors helps to protect installed static sensitive devices.



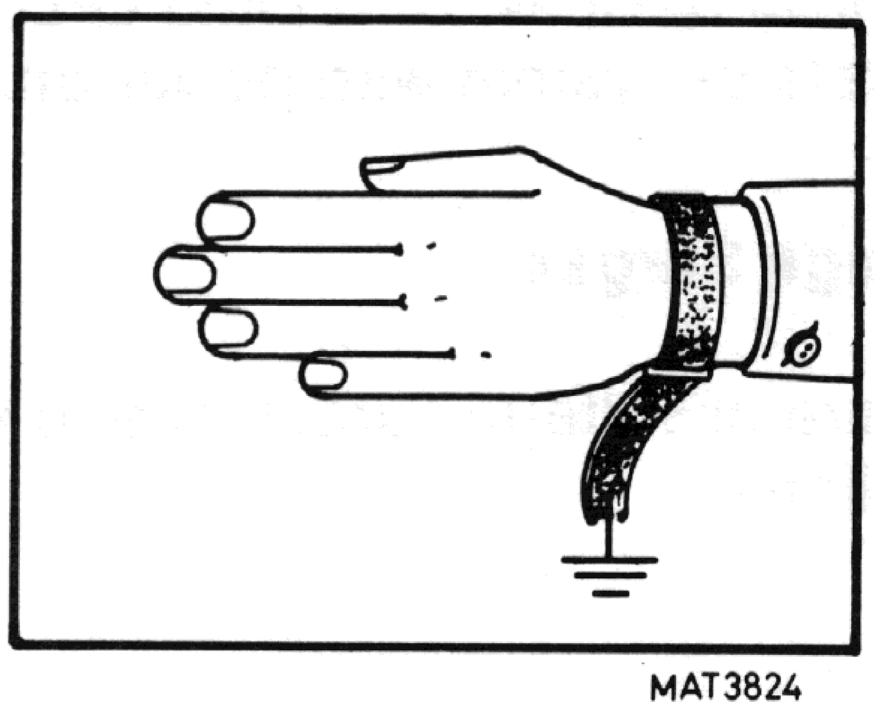
Minimize handling



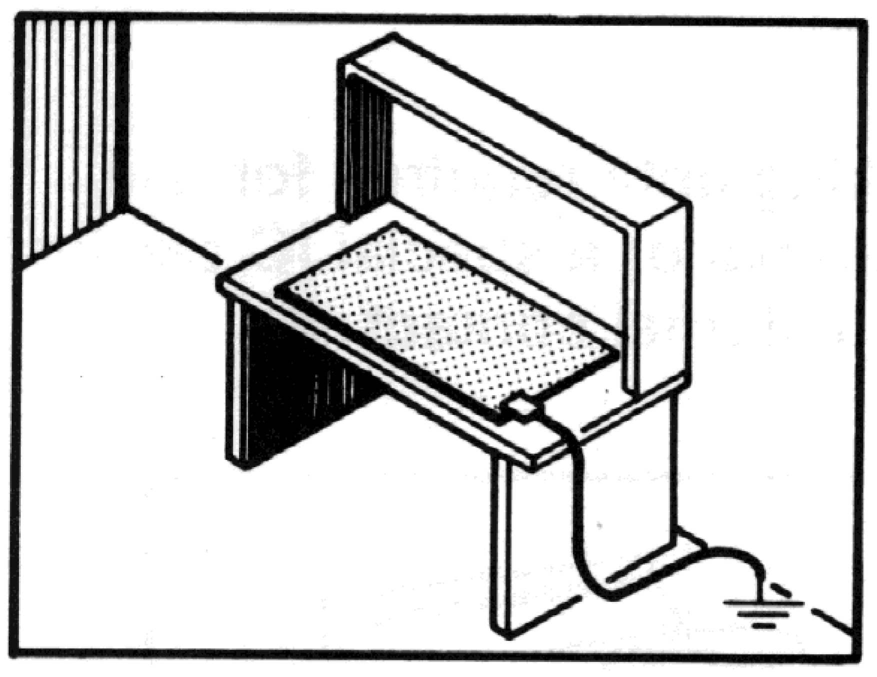
Handle the devices by the body



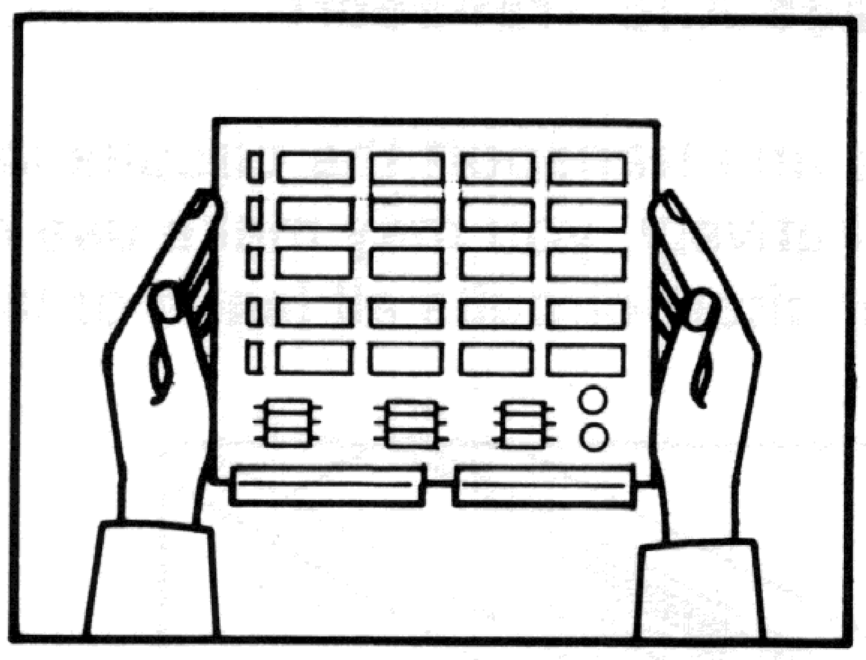
Do not slide the devices over any surface



Wear a conductive bracelet



Use a workbench with conductive surface



Handle plug-in units only by the non-conductive edges.

23.2.4 Mounting

Mount static sensitive integrated circuits on printed circuit boards after all other components have been mounted. Take care that the circuits themselves, metal parts of the board, mounting tools and the person doing the mounting are kept at the same electric (ground) potential.

NOTE: If it is impossible to ground the printed-circuit board, the person mounting the circuits should touch the conductive parts of the board before bringing the static sensitive circuits into contact with it.

23.2.5 Soldering

Soldering iron tips, including those of low voltage irons, or soldering baths should also be kept at the same potential as the static sensitive circuits and the board.

23.2.6 Static Charges

Dress personnel in clothing of non-electrostatic material (no wool, silk or synthetic fibres). Avoid these materials in the working area.
After the static sensitive circuits have been mounted, the proper handling precautions should still be observed.
Until the sub-assemblies are inserted into the complete system in which the proper voltages are supplied, the board is not more than an extention of the leads of the devices mounted on the board. To prevent static charges from being transmitted through the board wiring to the device it is recommended that conductive clips or conductive tape is put on the circuit board terminals.

23.2.7 Transient Voltages

To prevent permanent damage due to transfer voltages, do not insert or remove static sensitive devices, or printed circuit boards with static sensitive devices, from test sockets or system with power on.

23.2.8 Voltage Surges

Beware of voltage surges due to switching electrical equipment ON or OFF, relays and d.c. lines.

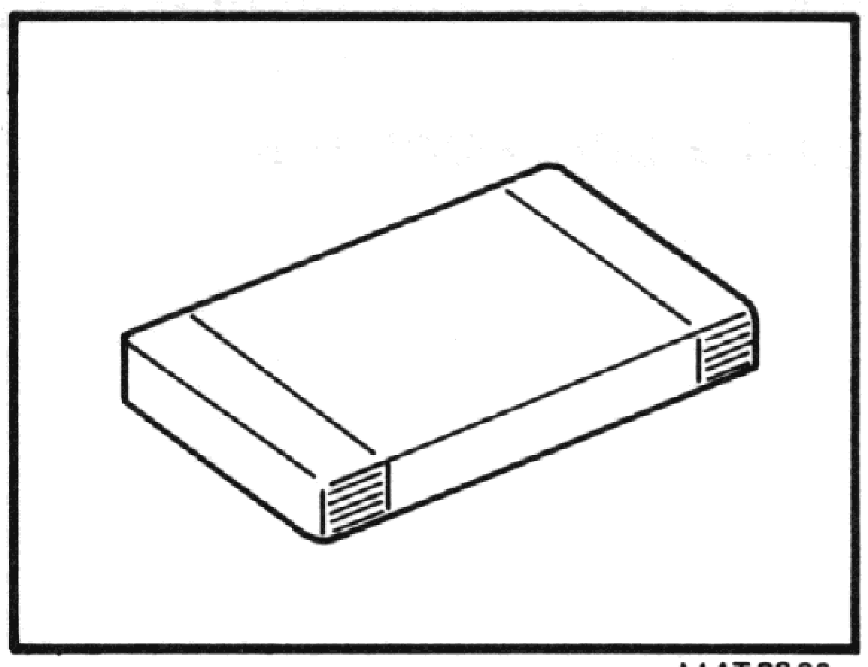
23.3 SOLDERING TECHNIQUES FOR SMD's

23.3.1 Introduction

This section deals with the removal and replacement method for surface mounted devices (SMDs). It incorporates subjects such as:
- Required tools and materials
- Replacement of SMDs
- General hints for SMD handling

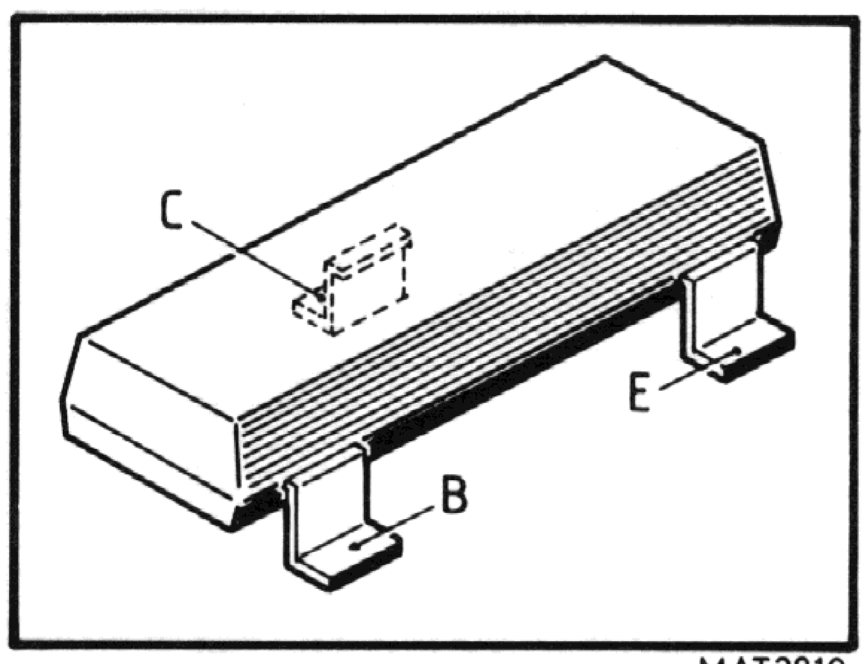
Surface-mounted components used in this instrument are:

- Chip components, such as resistors and capacitors
  These components are packaged in rectangular ceramic leadless bodies.
  For replacement, see Section 23.3.4.1.



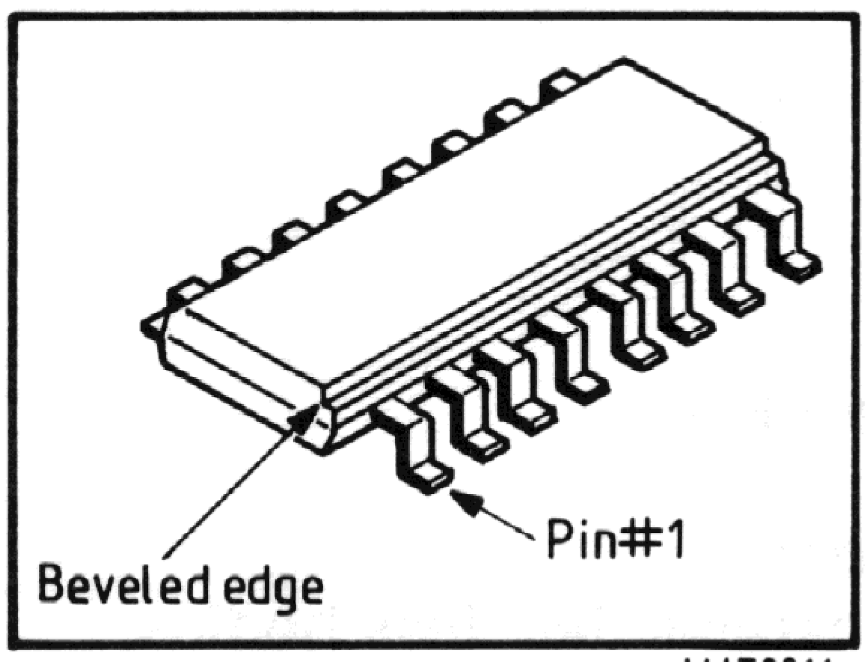
MAT3809

- Small outline transistor (SOT) packages, such as:
  SOT 23, SOT 143 and SOT 223.
  The leads are grouped with the collector on one side and the base-emitter leads on the opposite side, or for diode pairs (SOT 143) two by two leads which are grouped on both sides.
  For replacement, see Section 23.3.4.1.



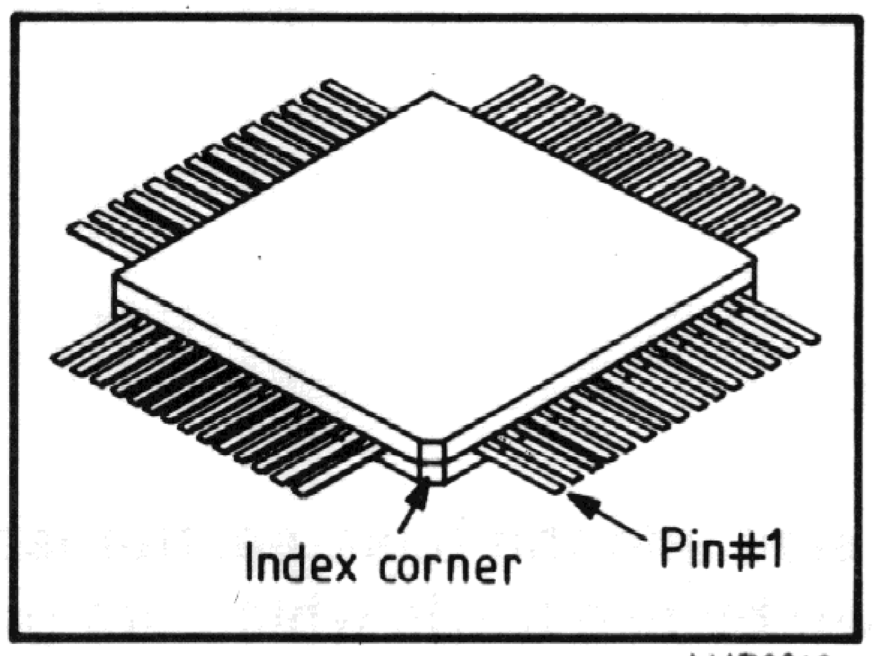
MAT3810

- Small outline integrated circuit (SOIC) packages, such as: SO 8, SO 14, SO 16, SO 16L, SO 20 and SO 28.
  The device is rectangular with gull-wing shaped leads at two sides. Pin #1 is located on the far left as you face the beveled side.
  For replacement, see Section 23.3.4.2



MAT3811

- Quad flatpack (QFP) packages, such as QFP 44 and QFP 80. The device is square with leads located on all four sides.
  Pin #1 is identified by a 45° index corner. Continue the pin count in a counter-clockwise direction.
  For replacement, see Section 23.3.4.2



MAT3812

23.3.2 Required Tools And Materials

To ensure proper repair of the surface mounted devices, the following tools have been carefully selected and are therefore recommended.

- A hot-air solder tool: Leister Hot-Jet
- Nozzles for the different packages
- Micro Electronic Systems (MES) repair kit, containing dispenser, vacuum pipette and different caplettes
- Mini soldering iron station: WECP-COD3 (regulated transformer) and Weller MLR-20 (mini soldering iron)

The following materials are recommended:

- Soldering tin, dia 0,8 mm, SnPb 60/40 with a Resin Mildly Activated (RMA) flux. Ordering code: 4822 390 80133
- Solder paste 026
- Non-corrosive and Resin Mildly Activated (RMA) flux- Colophony Ordering code: 4822 390 50025
- Desolder braided wire; ordering code: 4822 321 40042
- Magnifying glass 3x ... 10x

23.3.3 General Hints For Smd Handling

23.3.3.1 Tools

The removal and attachment method of SMD components mainly employs convection heating. This involves the application of hot air to the solder joints. For removing, nozzles are available for different size and shaped components. This permits the heat to be placed directly on the leads.
There are always two adjustments on the hot-air solder tool, one for temperature (50 ... 500 °C) and the other for the air flow.
Next, a mini soldering iron can be used to prepare the solder pads before attachment and to do any touchup work.

NOTE: The recommended Leister tools and Weller mini soldering iron can be ordered via your local dealer.

23.3.3.2 Electrostatic discharging (ESD)

All integrated circuits and many semi-conductors are susceptible to ESD. Careless handling during repair can reduce life drastically. To prevent any failure which is caused by static damage, some precautions must be taken for:
- Transportation: use static shielding bags and containers
- Working area: use anti-static mat and wristband, connected to earth potential

A complete description of ESD handling is given in Section 23.2.

23.3.3.3 *Fluxing and cleaning*

For optimal soldering result, solder flux must be used to chemically clean the metals and the solder. The flux removes oxide from the metals and acts as a wetting agent. Because the use of flux can cause electrical leakage problems in high-ohmic circuits, it is important to use non-corrosive and Resin Mildly Activated (RMA) flux, such as Colophony.

The flux residue left over after attachment the SMD components must be removed. To assure proper cleaning of the board, this must be done IMMEDIATELY after repair. The longer the flux remains on the board, the harder it is to clean.

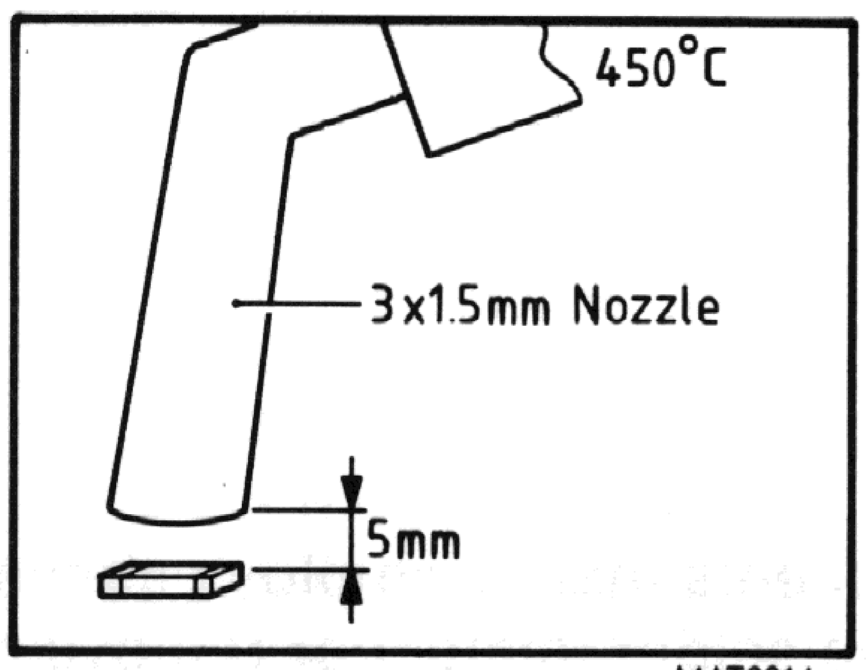
23.3.4 Replacement Of Smds

ATTENTION: The methods given are based on the restriction that the components once removed must NOT be used again.

23.3.4.1 *Replacement of SMDs with two up to four connections*

IMPORTANT: Before removing the component, observe very carefully its position in order to avoid that the new component is installed upside-down. This is especially important for capacitors and four-leads SOTs.

REMOVING:



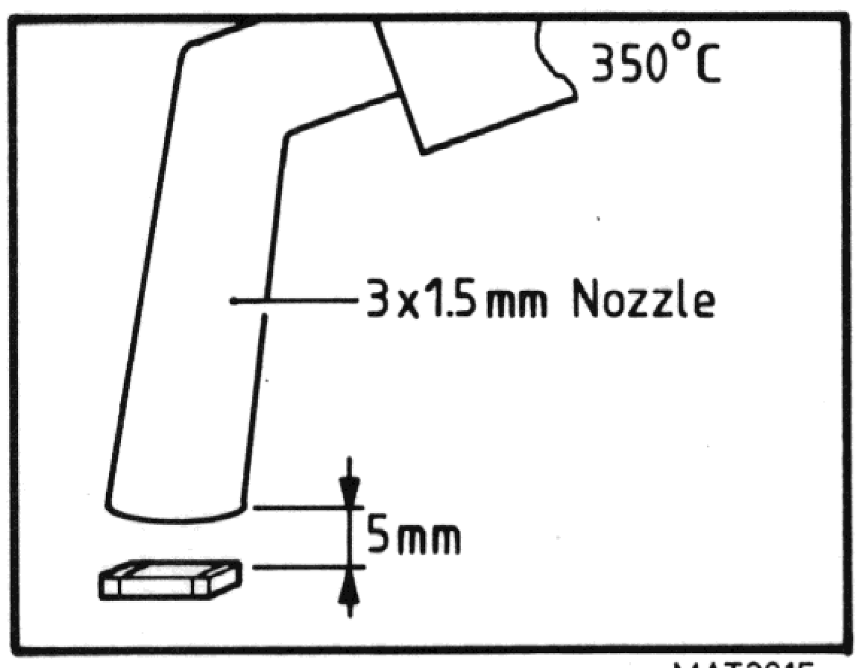
MAT3814

- Prepare the hot-air tool; attach a 3 x 1,5 mm oval tip nozzle, set the temperature of the hot gas to 450 °C and the air flow to "high".
- Hold the nozzle 5 mm above the component to be removed.
- Heat the component up equally for about 5 seconds.
- When the solder becomes molten, remove the component from the board using the vacuum pipette.

ATTENTION: Be careful that the adjacent components are not damaged by the hot-air flow.

- Remove the hot-air tool.
- Clean all pads with the braided wire.

ATTACHING:

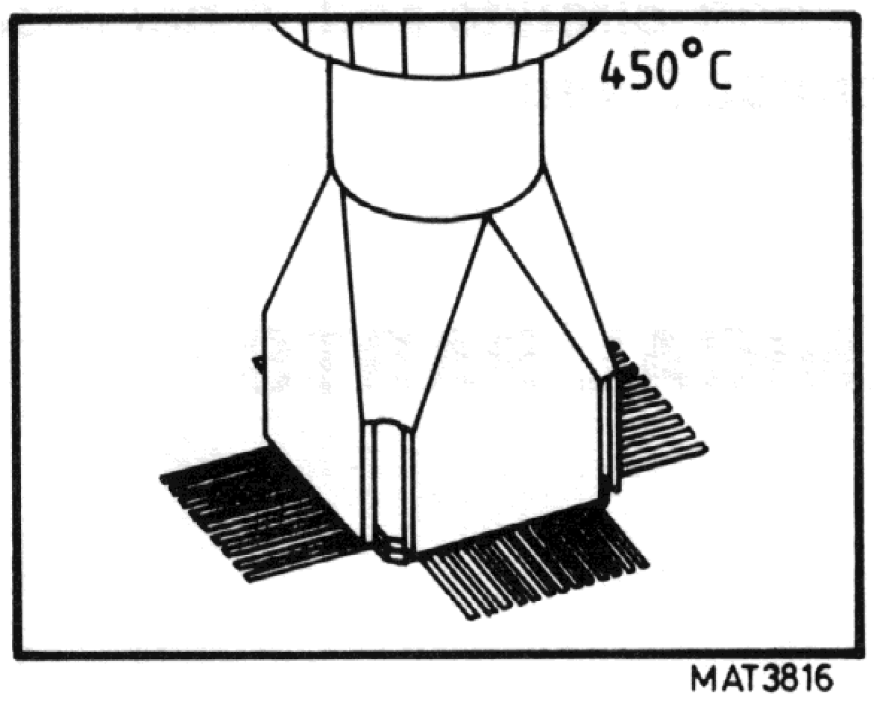


MAT3815

- Apply new solder paste in small dots to all soldering pads.
- Prepare the hot-air tool; use a 3 x 1,5 mm oval tip nozzle, set the temperature of the hot gas to 350 °C and the air flow to "low".
- Place the new component with a pair of tweezers on the sticky solder paste of the contact pads.
- Position the component well.
- Apply the heat from a distance of 5 mm in the direction of the solder paste.
- Allow even reflow of the solder, the soldering time per joint should be not more then about 10 seconds.
- Remove the hot-air tool.
- Clean the pcb very carefully; be sure to remove all flux residue.
- Inspect the solder joints and, if necessary, remove superfluous solder rests with the use of braided wire.

23.3.4.2 Replacement of SMDs with more connections

REMOVING:



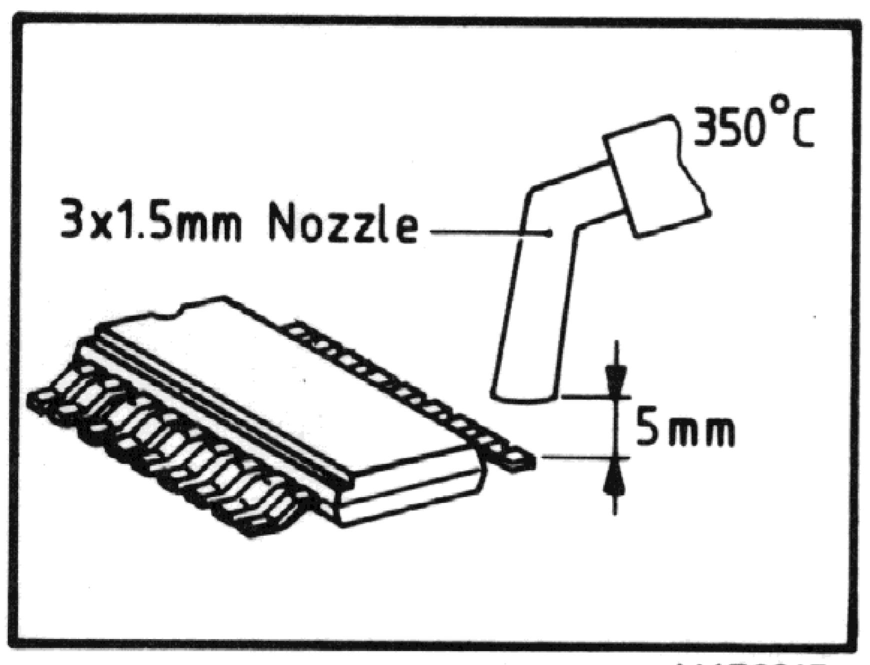
MAT3816

- Prepare the hot-air tool; attach a correct nozzle, set the temperature of the hot gas to 450 °C and the air flow to "high".
- Hold the nozzle on the component to be removed.
- Heat all connections of the component equally up for about 10 seconds.
- When the solder becomes molten, remove the component from the board using the vacuum pipette. Use a small screwdriver to break the glue bond when necessary.

ATTENTION: Be careful that the adjacent components are not damaged by the hot-air flow

- Remove the hot-air tool.
- Clean all pads with the braided wire.

ATTACHING:



MAT3817

- Apply a certain amount of flux to the soldering pads.
- Apply new solder paste in a straight line to the soldering pads.
- Prepare the hot-air tool; attach a 3 x 1,5 mm oval tip nozzle, set the temperature of the hot gas to 350 °C and the air flow to "low".
- Place the new component with a pair of tweezers on the sticky solder paste of the contact pads. Use the pin #1 location for reference.

ATTENTION: It is very helpful to use a magnifying glass having a magnification of 3 to 10 to check the correct position of all leads.

- Fix the component with a small soldering tip by briefly heating soldering pads in two diagonally opposite corners.
- Apply the heat from a distance of 5 mm in the direction of the solder paste.
- Slowly move the nozzle over the row of solder joints.
- Allow even reflow of the solder, the soldering time per joint should be not more then about 10 seconds.
- Remove the hot-air tool.
- Clean the pcb very carefully; be sure to remove all flux residue.
- Inspect the solder joints for good connections or short-circuits and, if necessary, remove superfluous solder rests with the use of braided wire.

23.4 REMOVING THE UNITS AND MECHANICAL PARTS

NOTE: For installation, reverse the sequence.

23.4.1 Attenuator unit (A1)

- First remove the digital unit (see section 23.4.8).
- Push gently both clamping lips that secure the metal locking plate for the attenuator unit and remove the locking plate.
- Push the attenuator unit backwards for about 1 cm.
- Remove the front unit (see section 23.4.7).
- Remove the control knobs of the CRT control unit.
- Pull gently both clamping lips that secure the front profile gently backwards and loosen the front profile.

ATTENTION: To avoid damage, ensure that the BNCs of the attenuator unit are behind the front profile before loosening the front profile.

Now the attenuator unit can easily pulled out of the instrument after removing the connector with flat cable and the ground connector.

Dismantling the Attenuator unit:
- For access to the components of the unit, remove both upper and bottom covers.
- When removing the BNCs first unsolder the wire to the pcb and then unscrew the BNC-nut with a spanner of max. 5 mm thickness.

23.4.2 Pre-amplifier unit (A2) and Adaptation unit (A16)

- First remove the P^2CCD unit (see section 23.4.9).
- Then remove the time-base unit (see section 23.4.4).
- Unlock the two p.c.b. supports
- The complete p.c.b. can be removed from the instrument after having removed all flat cables.

23.4.3 XYZ-amplifier unit (A3)

The XYZ amplifier unit incorporates two separate p.c.b.'s connected via a flat cable. One p.c.b. includes among other things the CRT socket and must be loosened first. For this, the CRT socket must be gently removed from the CRT.
Now the part situated above the CRT can be removed as follows:

- Remove all flat cables and the delay line cable plug.
- Pull all six clamping lips that secure the XYZ-amplifier unit p.c.b. outwards and take out the complete unit.

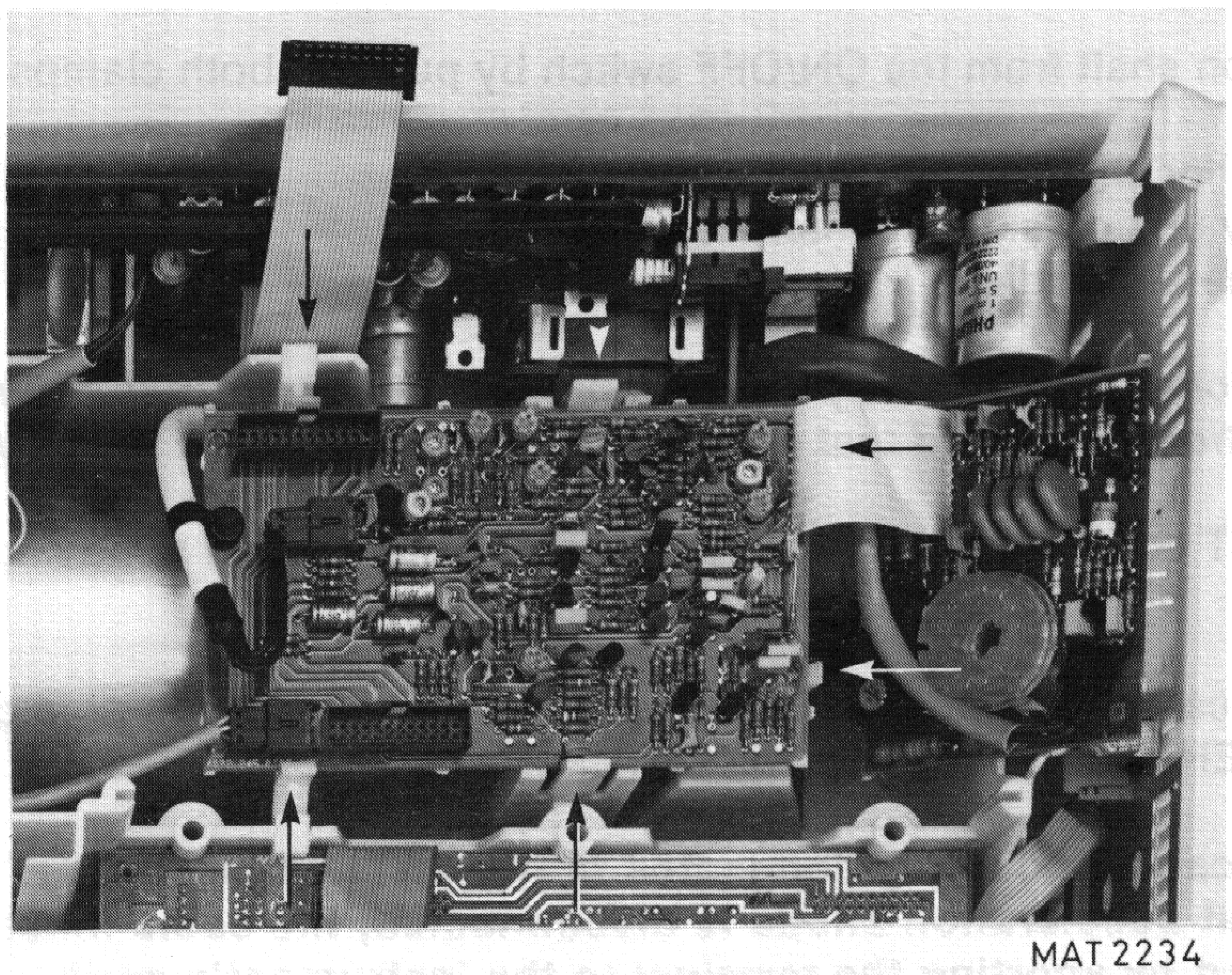


Figure 23.2 Six clamping lips for XYZ-amplifier unit

23.4.4 Time-base unit (A4)

- Remove the P^2CCD unit (see section 23.4.9).
- Unlock the p.c.b. support with a special tool that fits the diameter of the p.c.b. support (see section 23.8.2).
- The complete p.c.b. can be taken out of the instrument after having removed all flat cables.

23.4.5 CRT control unit (A5)

- Remove the front unit (see section 23.4.7)
- Loosen the front profile (see section 23.4.1)
- Now the CRT control unit can be pulled out of the front profile after having removed the flat-cable and the CAL connector.

23.4.6 Power supply unit (A6)

WARNING: Inside the power supply pcb there are many parts that carry dangerous high voltages. Some of these voltages remain some time after disconnecting the instrument from the mains. Therefore, it is recommended to wait at least five minutes after having disconnected the instrument from the mains, before removing the p.c.b. If working on the power supply unit under live condition cannot be avoided, it must be done by a qualified technician who is aware of the dangers involved.

- Remove the extension shaft from the ON/OFF switch by pushing both clamps of the shaft together.
- Push both clamping lips that secure the power supply unit.
- Lift the power supply unit outside the instrument.
- Place the p.b.c. in the unit slider.

NOTE: After the mentioned actions, the power supply unit can be measured under working conditions, provided that all cables are still connected to the unit.

The flat cable to the CRT control unit can easilly be removed now when removing this unit.

- Remove the two flat cables, the power supply cable, the two- and three-pole cable connectors and the EHT-connector from the CRT.

WARNING: The EHT cable is directly connected to the CRT. When the EHT cable to the post-acceleration anode is disconnected, the cable must be discharged by shorting the terminal to the instrument's earth.

- The power supply can now be taken out of the instrument.

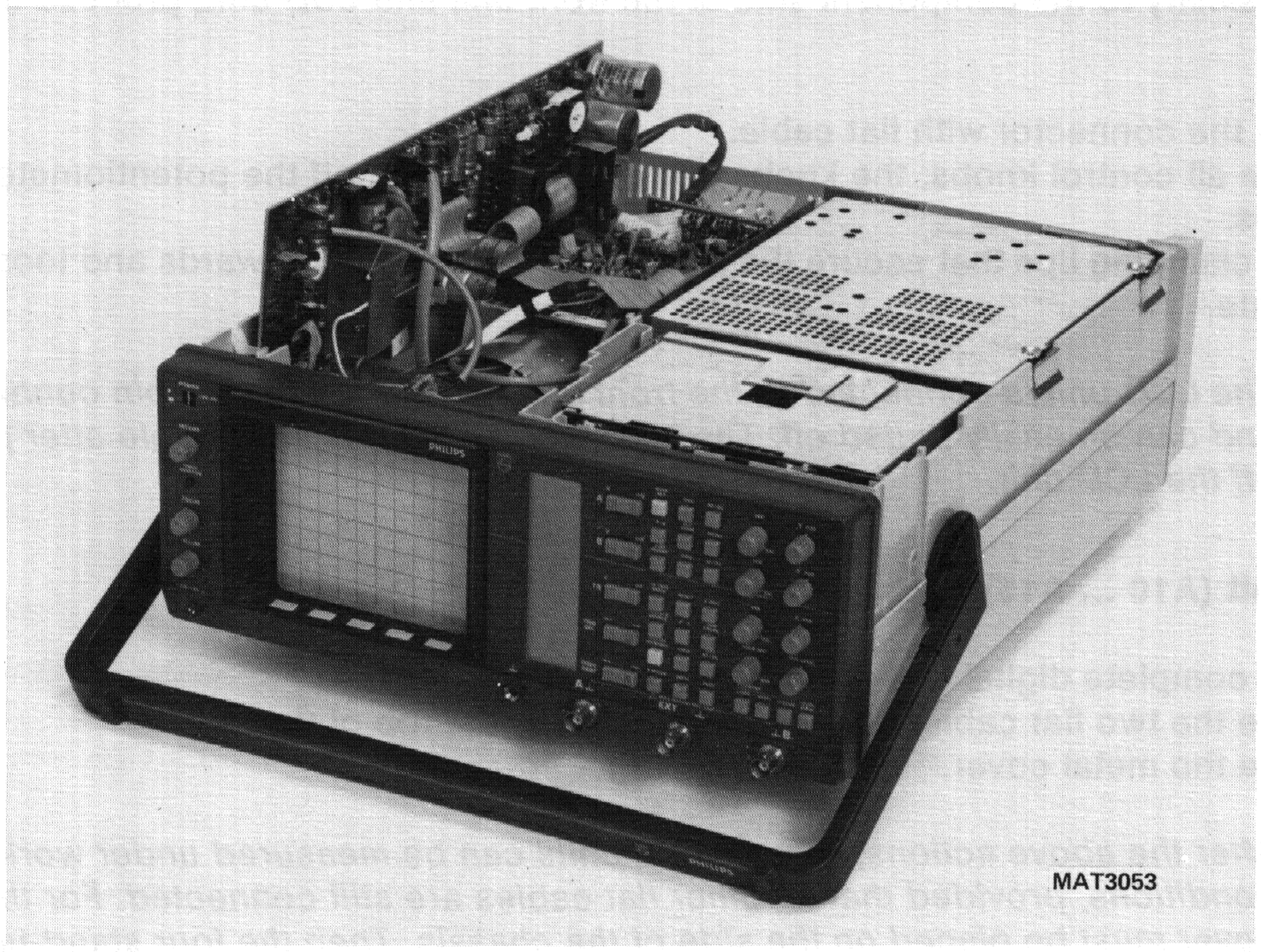


Figure 23.3 Power supply unit outside the instrument

23.4.7 Front unit (A7) and LCD unit (A8)

- Unscrew the two screws, located at the rear of the front unit.
- Now the complete unit assembly can be slid out of the front profile of the instrument.

NOTE: *After the above actions, the front unit can be measured under working conditions, provided that the flat cable is still connected to the unit.*

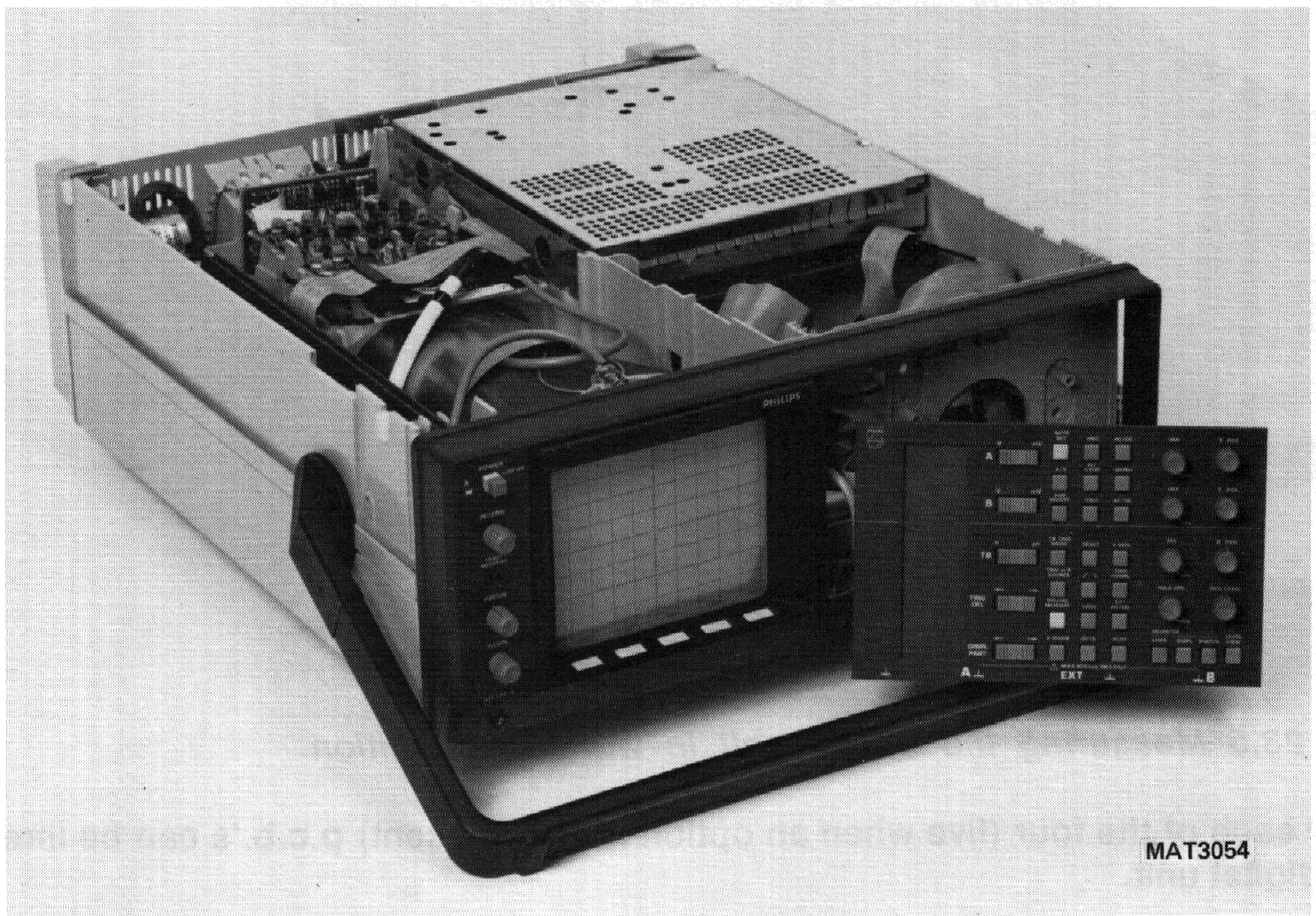


Figure 23.4 Measuring the front unit working condition

For accessibility to the component side of the front unit and LCD unit, proceed as follows:

- Unplug the connector with flat cable.
- Remove all control knobs; the knobs can be easily pulled off the potentiometer spindles.
- Pull all clamping lips that secure the front unit p.c.b. gently outwards and loosen the text plate.

NOTE: The LCD unit is connected to the front unit by means of two 3-pin connectors and can be easily pulled off. The LCD display lamp is accessible after pulling off the LCD unit.

23.4.8 Digital unit (A10 ... A15)

- Lift the complete digital unit outside the instrument.
- Remove the two flat cables that are connected at the top of the unit.
- Remove the metal cover.

NOTE: After the above actions, all separate units can be measured under working conditions, provided that all other flat cables are still connected. For this the cover must be placed on the side of the chassis. Then the four stand-ups on unit A10 must be placed in the four already existing holes on the cover.

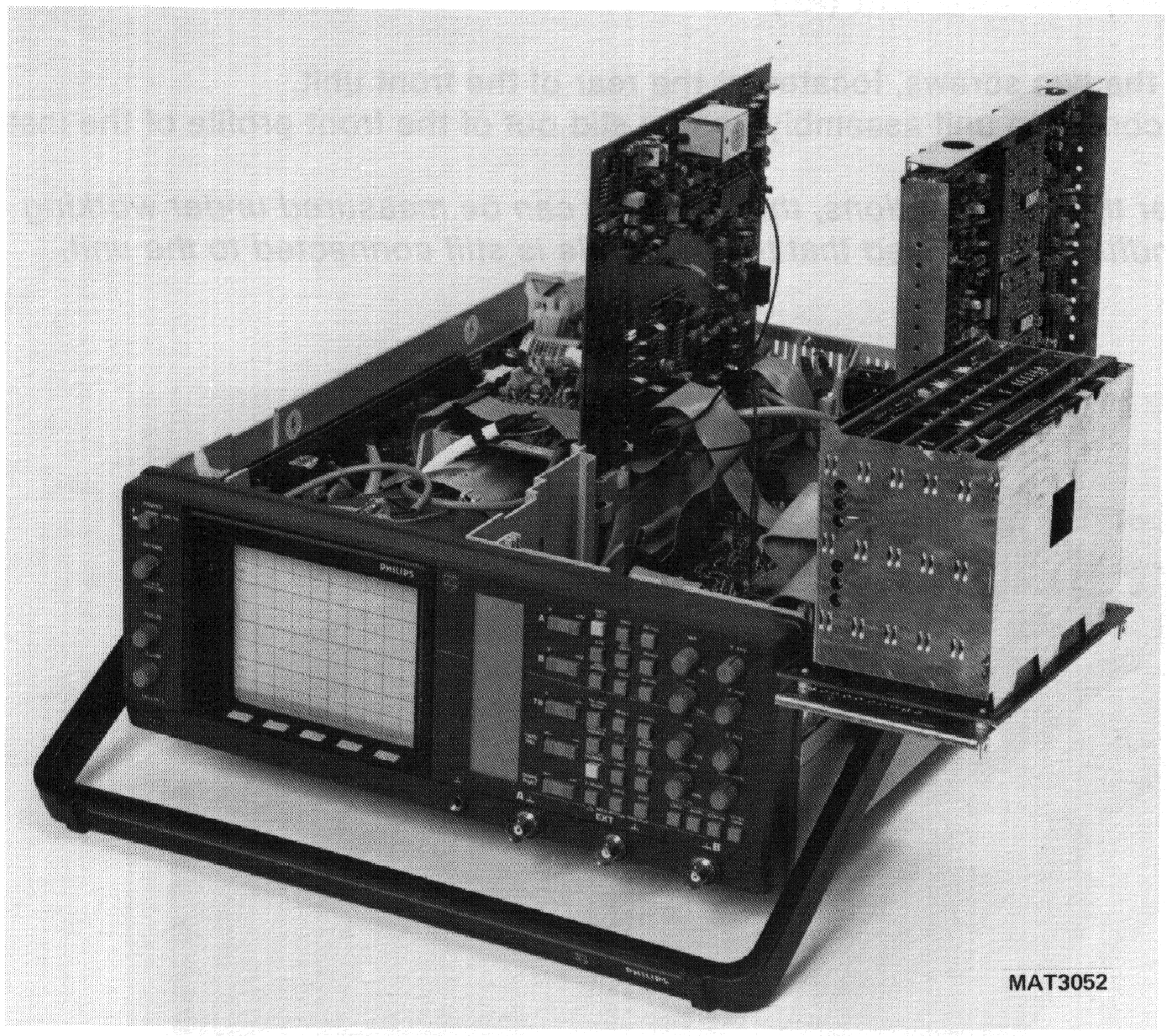


Figure 23.5 Measuring the digital unit in working condition

- Now each of the four (five when an option is also present) p.c.b.'s can be lifted out of the digital unit.

23.4.9 P^2CCD unit (A18) and mini CCD unit (A17)

- Unscrew the two screws that fix the metal cover to the chassis and take-off the cover.
- The complete p.c.b. with metal under cover can be taken out of the instrument after removing all 50 Ω cables, all flat cables and the metal bracket on the chassis.
- Now the p.c.b. can be removed from the metal under-cover by unscrewing the four screws.

- The mini CCD units can easily be taken out of their sockets (PM3365A/67A only).

23.4.10 Removing the delay-line cable

The delay-line cable is a 54 cm cable that is connected to the amplifier unit and to the XYZ amplifier unit.
To remove the delay-line cable, proceed as follows:

- For access to the delay line cable, remove the time-base unit (see section 23.4.4) and the pre-amplifier unit (see section 23.4.2).
- Unlock the plastic clamps that fix the cable to the instrument's chassis and to the units.
- Remove the plug that connects the delay-line cable to the pre- amplifier unit.
- Unscrew the plastic clamp that fixes the cable to the XYZ-amplifier unit.
- Remove the plug that connects the delay-line cable to the XYZ- amplifier unit.

23.4.11 Replacement of CRT

IMPORTANT: It is strongly recommended to study of this chapter and the associated illustration (figure 23.6) before starting replacement.

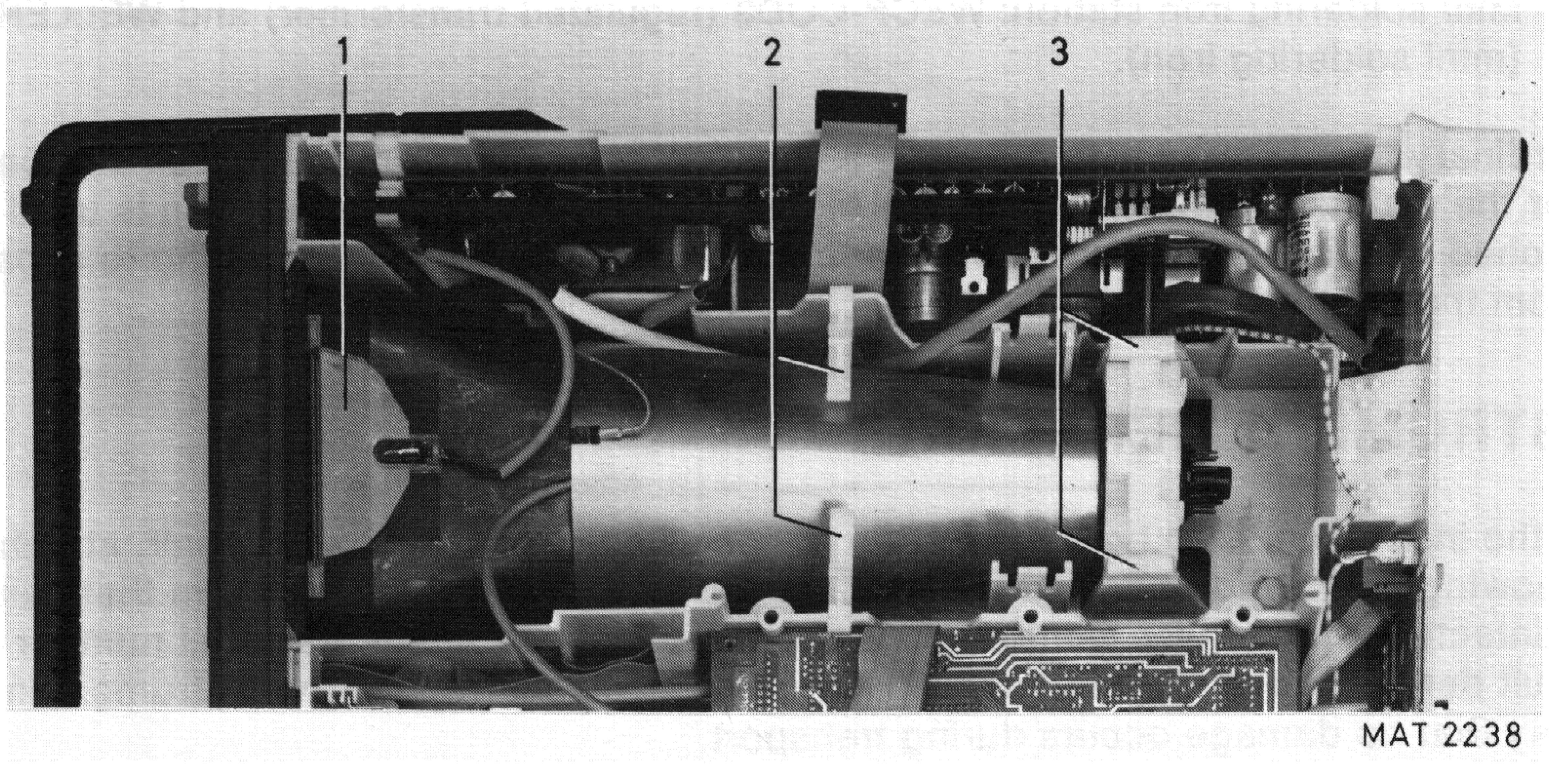


Figure 23.6 Removing the CRT

- Remove the XYZ-amplifier unit, see section 23.4.3.
- Remove the graticule lamp holder (1).
- Remove the bezel with the screen filter.
- Remove the two plastic pcb supports (2).
- Unlock the EHT-cable.

WARNING: Handle the CRT carefully. Rough handling or scratching can cause the CRT to implode.

- Push the two clamping lips that secure the CRT support (3) and gently lift the CRT, incl. metal shielding out of the instrument.

NOTE: *Before re-assembling a new CRT, first remove its protective cover and place the CRT front rubber around the CRT-front.*

23.5 SOLDERING TECHNIQUES

Working method:

- Carefully unsolder one after the other the soldering leads of the semi-conductor.
- Remove all superfluous soldering material. Use desolder braided wire; ordering code: 4822 321 40042.
- Check that the leads of the replacement part are clean and pre-tinned on the soldering place.
- Locate the replacement semi-conductor exactly on its place, and solder each lead to the relevant printed conductor on the circuit board.

NOTE: *Bear in mind that the maximum permissible soldering time is 10 seconds during which the temperature of the leads must not exceed 250° C. The use of solder with a low melting point is therefore recommended.*
Take care not to damage the plastic encapsulation of the semi-conductor (softening point of the plastic is 150° C).

ATTENTION: *When you are soldering inside the instrument, it is essential to use a low-voltage soldering iron, the tip of which must be earthed to the mass of the oscilloscope.*

A suitable soldering irons is:

- Mini soldering iron station: WECP-COD3 (regulated transformer) and WELLER MLR-20 (mini soldering iron).

Ordinary 60/40 solder with core and 35 to 40 W pencil type soldering iron can be used for the majority of the soldering. If a higher wattage-rating soldering iron is used on the etched circuit boards, excessive heat can cause the etched circuit wiring to separate from the board base material.

23.6 INSTRUMENT REPACKING

If the instrument is to be shipped to a Service Centre for service or repair, attach a tag showing the full address and the name of the individual at the users firm that can be contacted. The Service Centre needs the complete instrument, its serial number and a fault description. If the original packing is not available, repack the instrument in such a way that no damage occurs during transport.

23.7 TROUBLE SHOOTING

23.7.1 Introduction

The following information is provided to facilitate trouble shooting. Information contained in other sections of the manual should also be used to locate the defect. An understanding of the circuit is helpful in locating troubles, particularly where integrated circuits are used. Refer to the circuit description for this information.

23.7.2 Trouble-shooting techniques

If a fault appears, the following test sequence can be used to find the defective part:

- Check if the settings of the controls of the oscilloscope are correct.
- Check the equipment to which the oscilloscope is connected and the interconnection cables.
- Check if the oscilloscope is well-calibrated. If not, refer to section 22. "Checking and Adjusting".
- Visually check the part of the oscilloscope in which the fault is suspected. In this way, it is possible to find faults such as bad soldering connections, bad interconnection plugs and wires, damaged components or transistors and IC's that are not correctly plugged into their sockets.
- Location of the circuit part in which the fault is suspected: the symptom often indicates this part of the circuit. If the power supply is defective the symptom will appear in several circuit parts.

After having carried out the previous steps, individual components in the suspected circuit parts must be examined:

- Transistors and diodes.
  Check the voltage between base and emitter (0,7 V approx. in conductive state) and the voltage between collector and emitter (0,2 V approx. in saturation) with a voltmeter or an oscilloscope. When removed from the p.c.b. it is possible to test the transistor with an ohmmeter since the base/collector junctions can be regarded as diodes. Like a normal diode, the resistance is very high in one direction and low in the other direction. When measuring take care that the current from the ohmmeter does not damage the component under test. Replace the suspected component by a new one if you are sure that the circuit is not in such condition that the new component will be damaged.
- Integrated circuits.
  In circuit, testing can be done with an oscilloscope or voltmeter. A good knowledge of the circuit part undertest is essential. Therefore, first read the circuit descriptions in sections 3...19.
- Capacitors.
  Leakage can be traced with an ohmmeter adjusted to its highest resistance range. When testing take care of polarity and maximum allowed voltage. An open capacitor can be checked if the response for AC signals is observed. Also a capacitance meter can used: compare the measured value with the value and tolerance indicated in the parts list.
- Resistors.
  Can be checked with an ohmmeter after having unsoldered one side of the resistor from the p.c.b. Compare the measured value with the value and tolerance indicated in the parts list.

- Coils and transformers.
  An ohmmeter can be used for tracing an open circuit. Shorted or partially shorted windings can be found by checking the waveform responses when HF signals are passed through the circuit. Also an inductance meter can be used.
- Data latches.
  To measure on inputs and outputs of data latches a measuring oscilloscope can be triggered by the clock signal which is connected to the clock input of the data latch. This measurement can only be made in this way when there is an acceptable repetition time of the clock signal. A too low clock pulse repetition time results in a low intensity of the trace on the measuring oscilloscope screen.
  The outputs can easily be checked by a voltmeter or oscilloscope.

23.7.3 Power-up routine

Every time the instrument is switched-on the following initialisation program is executed:

- Checking the CPU.
- Initialisation of the I^2C bus (if correct, all relevant LCD segments light for about 1 sec).
- Back up test.
- Initialisation of the variables.
- Checking if service routine is required (if yes, the program will continue with the service routine).
- Checking the "WATCH-DOG" on A12 .
- Eventually initialisation of the option.

If during the program-run a circuit is found to be faulty, the program stops. It is recommended to switch-off and after a few seconds switch- on again. This will reset the micro-computer controlled system automatically. If the instrument goes in the same faulty situation again, the following procedure indicates how to handle. If no failure is found, all relevant LCD-segments will be lighting for about one second. After this the normal program is executed.

PROCEDURE:

Check if the LCD is lighting for about one second. If not, close solder-joint J202 on unit A12 and measure on testpin X223. If a square-wave is measured with a 6 μs high period and a 8 μs low period then the μProc. RAM is defective or one or more address/data lines are short circuited. If the LCD has lighted for about one second and the program stops, close also solder-joint J202 and measure on testpin X223. If now a pulse is measured with a 5 μs high period and a 15 μs low period then the I^2C bus is defective. On the SCL a clockpulse must be present when a softkey (e.g. AUTO SET) is depressed while the SDA gives the data information (looks like a random pulse).
If one of these signals is not present, you can localize on what unit the fault exists. This can be done by first unplug connector X1009, X2001 or X101 on resp. A1, A2 and A11. To localize what serial- parallel conversion IC is defective, you can disconnect the solder joint in the SDA and SCL print track lead to that IC. The following IC's can disconnected in this way: D1001, D1101, D2602, D2603, D4001, D4002, D4401, N103, N104 and N106 (see also figure 23.7).

When the instrument restarts every time again, this means the WATCHDOG is initiating the main program (see also section 13.3), the watchdog can be disabled. This can be done by means of removing R204 on unit A12. When disabled, pin 36 and pin 37 of the microprocessor are set to a low level.

23.7.4 I^{2}C structure

The I^{2}C bus is for 2-way, 3-line communication between different ICs or modules. The three lines are a serial data line (SDA), a serial clock line (SCL) and ground. Both lines must be connected to a positivesupply via a pull-up resistor when connected to the output stages of a device. Data transfer may be initiated only when the bus is not busy.

The lines SDA and SCL are fed to the various circuits, where depending on the addressing, the serial information is converted into the different control signals (see figure 23.7).

Note that for servicing, solder joints are added in the p.c.b. tracks connecting the circuits. These can be used to localize a fault in the I^{2}C bus by means of interrupting the bus connection.

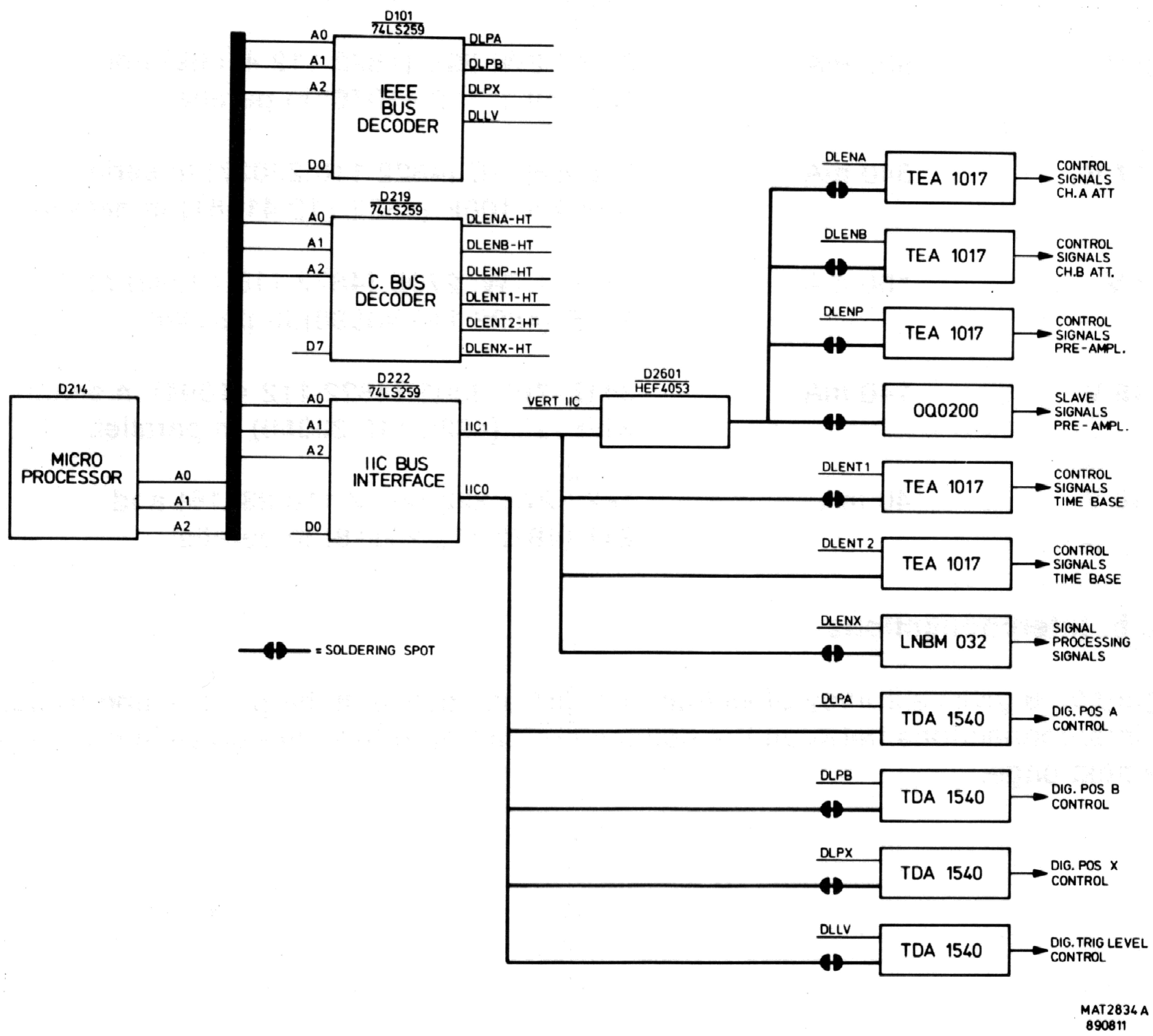


Figure 23.7 I^{2}C structure

23.7.5 Trouble-shooting the power supply

To determine whether a certain fault condition is initiated by the power supply itself or by the connected oscilloscope circuits, a dummy load is listed in the table below. The table gives also an example of the resistor types that can be used to compose the dummy load. These resistors can be ordered at Concern Service.

Supply voltage	Output current	Dummy resistance and their service ordering numbers
+ 5 V	2,4 A	2,9E-12W: 3 x 10E (4822 112 21052) and 22E (4822 11221063) in parallel.
- 6,4 V	930 mA	6,9E-6W: 8,2E (4822 112 41052) and 47E (4822 110 23072) in parallel.
+ 12 V	720 mA	17,2E-8,7W: 33E (4822 112 41067) and 39E (4822 112 43069) in parallel.
- 12 V	500 mA	24,7E-6W: 39E (4822 112 41069) and 68E (4822 112 41076) in parallel.
+ 17 V	340 mA	51E-6W: 1E (4822 110 23027) in serial with 2 x 100E (4822 112 41081) in parallel.
- 17 V	100 mA	171E-1,7W: 270E (4822 110 43092) and 470E (4822 110 43098) in parallel.
+ 48 V	140 mA	341E-7W: 330E (4822 112 41094) in serial with 12E (4822 110 23056) in parallel.
+ 48 V	40 mA	1k22-2W: 2k2 (4822 110 23116) and 2k7 (4822 110 23118) in parallel.

23.7.6 p.c.b. Interconnections

Figure 23.8 gives a survey of all interconnections between the p.c.b.'s and to the CRT. All interconnections between the connectors on board level are given in the diagram on the next page.

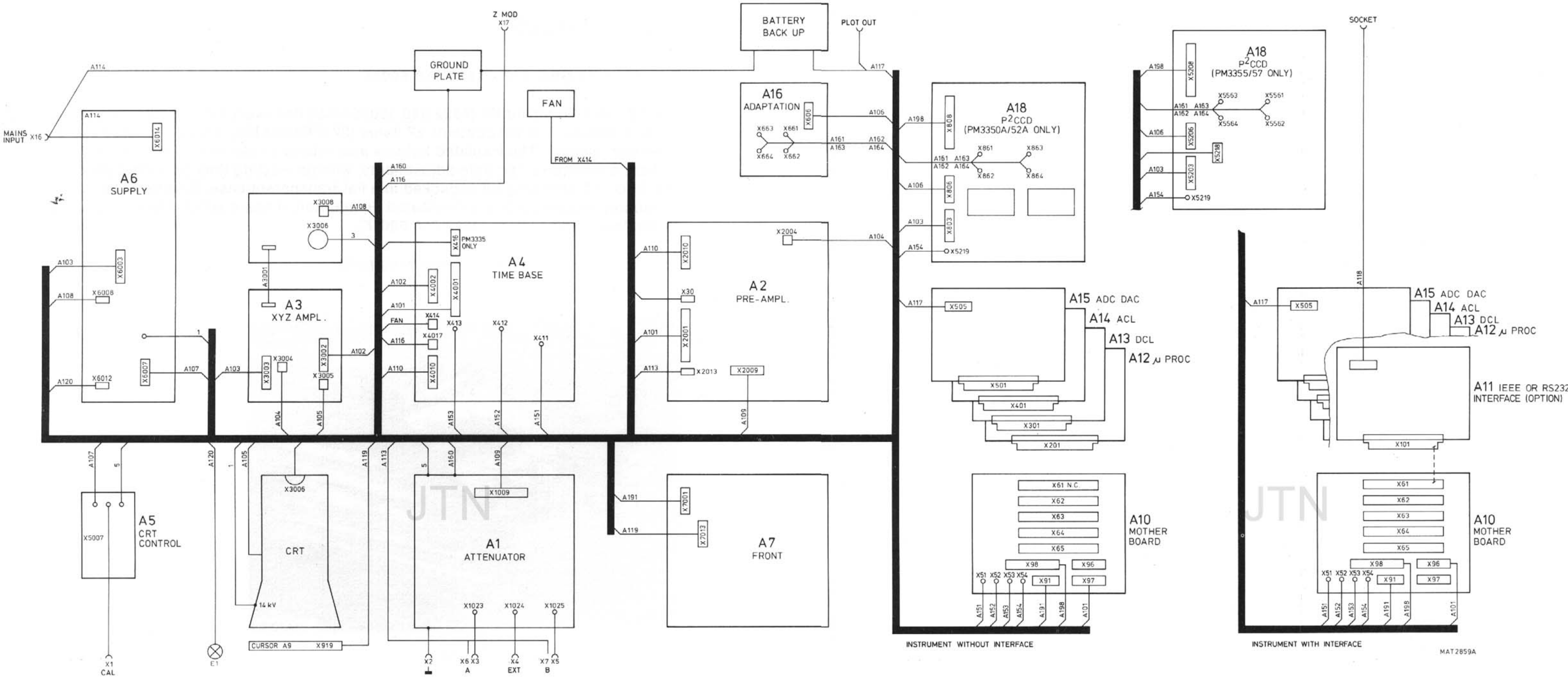
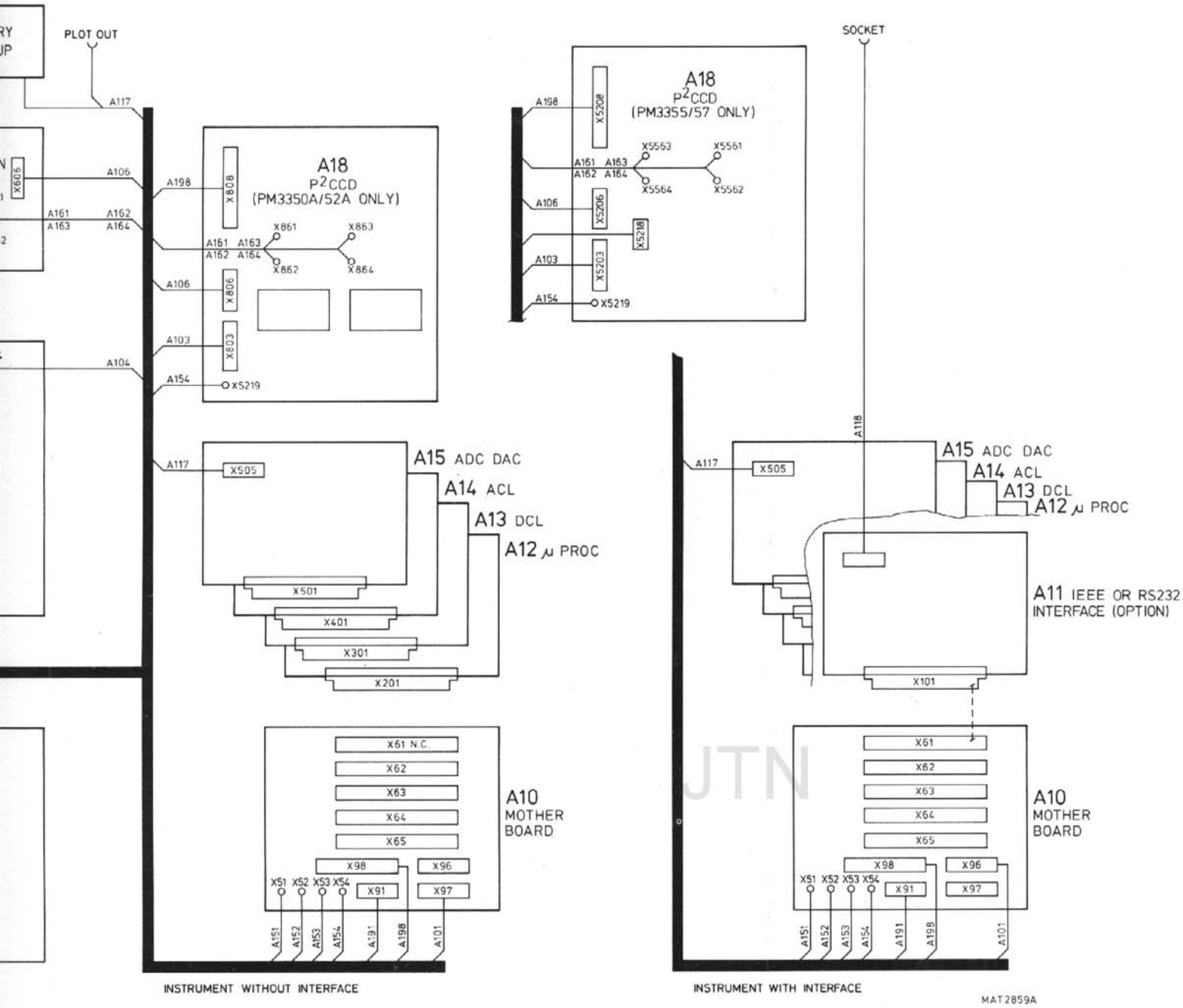


Figure 23.8 p.c.b. Interconnections



PLOT OUT
SOCKET
A18
P2CCD
(PM3350A/52A ONLY)
A18
P2CCD
(PM3355/57 ONLY)
A15 ADC DAC
A14 ACL
A13 DCL
A12 μ PROC
A11 IEEE OR RS232
INTERFACE (OPTION)
A10
MOTHER
BOARD
X61 N.C.
X62
X63
X64
X65
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X51 X52 X53 X54
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X401
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X606
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A161 A163
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A154
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A152
A153
A191
A101
INSTRUMENT WITHOUT INTERFACE
INSTRUMENT WITH INTERFACE
MAT2859A

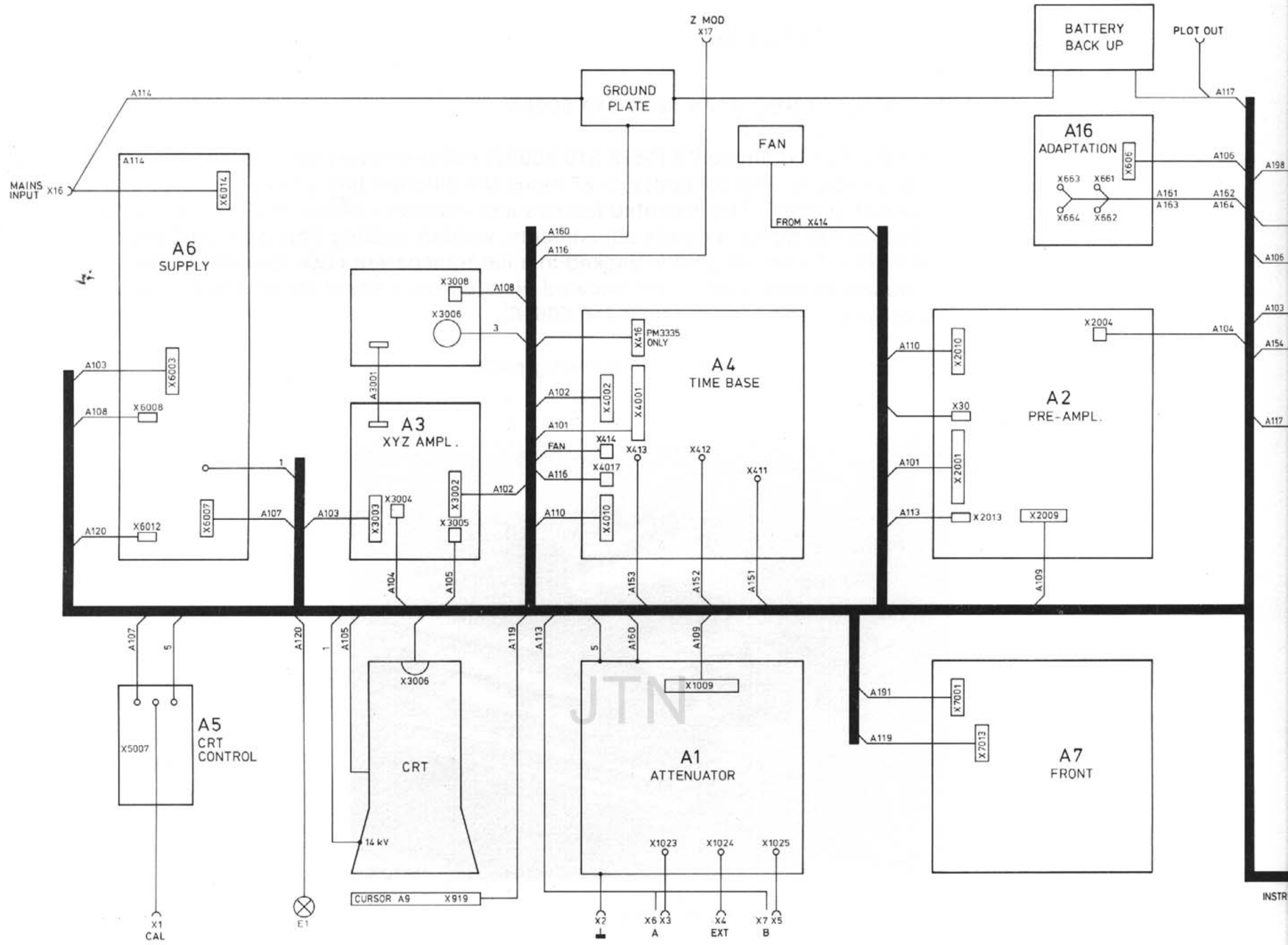


Figure 23.8 p.c.b. Interconnections

23.8 SPECIAL TOOLS

23.8.1 Trimming Kit SBC 317 - 4822 310 50095

The SBC 317 Trimming Kit (4822 310 50095) matches every current trimming requirement for all products. The set contains 27 items (22 different bits, plus 3 bit holders and 2 extension pieces). The insulated holders and extension pieces make it easy to reach into a chassis and make accurate adjustments, without wasting time or risking shocks.
The SBC 317 Trimming Kit is packed in a flat transparent case. Several of the most commonly required bits are duplicated. In addition, a spare set of 8 bits is separately available as replacement (4822 310 50016).

The Trimming Kit contains the following parts:

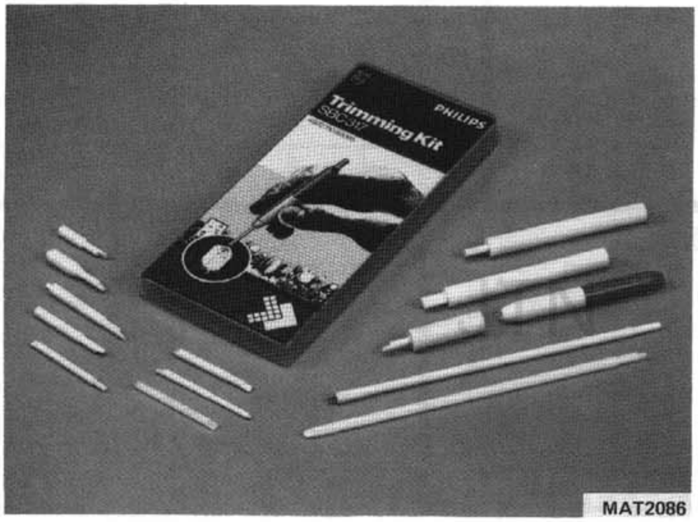


Figure 23.9 Trimming tool kit

23.8.2 p.c.b. Snapper - 5322 535 91942

A special tool is available for removal of the p.c.b. from the p.c.b. supports. Information on how to use this tool is given in chapter 23.4. The ordering number of this tool is 5322 535 91942

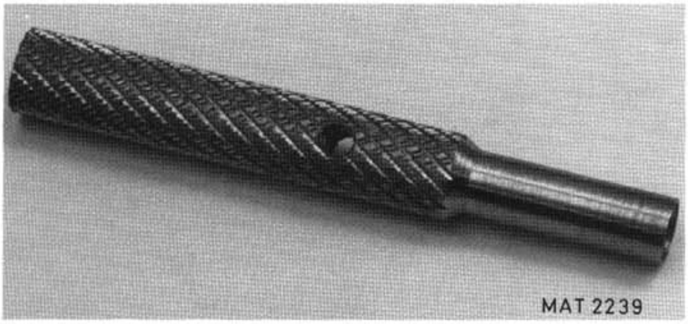


Figure 23.10 p.c.b. Snapper

23.8.3 Extension board - 5322 216 51211

For test and repair purposes the unit A11...A15 can be plugged in their connectors via an extension board. This board is available under codenumber 5322 216 51211.

23.9 RECALIBRATION AFTER REPAIR

After any electrical component has been renewed the calibration of its associated circuit should be checked, as well as the calibration of other closely-related circuits.
Since the power supply affects all circuits, calibration of the entire instrument should be checked it work has been done in the power supply or if the transformer has been renewed.

24 SAFETY INSPECTION

24.1 GENERAL DIRECTIVES

- Take care that the creepage distances and clearances have not been reduced.
- Before soldering, the wires should be bent through the holes of solder tags, or wrapped around the tag in the form of an open U, or wiring ridigity shall be maintained by cable clamps or cable lacing.
- Replace all insulating guards and -plates.

24.2 SAFETY COMPONENTS

Components in the primary circuit may only be renewed by components selected by Philips, see also section 23.1.2.

24.3 CHECKING THE PROTECTIVE EARTH CONNECTION

The correct connection and condition is checked by visual control and by measuring the resistance between the protective lead connection at the plug and the cabinet/frame. The resistance shall not be more than 0,1 Ω. During measurement the mains cable should be removed from the mains. Resistance variations indicate a defect.

24.4 CHECKING THE INSULATION RESISTANCE

Measure the insulation resistance at U = 500 V dc between the mains connections and the protective lead connections. For this purpose, set the mains switch to ON. The insulation resistance shall not be less than 2 MΩ.

NOTE: 2 MΩ is a minimum requirement at 40° C and 95% Relative Humidity. Under normal conditions the insulation resistance should be much higher (10 ... 20 MΩ).

24.5 CHECKING THE LEAKAGE CURRENT

The leakage current shall be measured between each pole of the mains supply in turn, and all accessible conductive parts connected together (including the measuring earth terminal). The leakage current is not excessive if the measured currents from the mentioned parts do not exceed 0,5 mA rms.

24.6 VOLTAGE TEST

The instrument shall withstand, without electrical breakdown, the application of a test voltage between the supply circuit and accessible conductive parts that are likely to become energized. The test potential shall be 1500 V rms at supply-circuit frequency, applied for one second. The test shall be conducted when the instrument is fully assembled, and with the primary switch in the ON position.
During the test, both sides of the primary circuit of the instrument are connected together and to one terminal of the voltage test equipment; the other voltage test equipment terminal is connected to the accessible conductive parts.

25 PARTS LIST

(subject to alteration without notice)

25.1 MECHANICAL PARTS

At the time of printing this Service manual, the oscilloscopes are changed from the old "brown" colour into the new "grey" colour.

The parts lists below indicate the ordering codes for both coloured mechanical parts (brown and grey). Only the parts with changed colour are indicated in the "new" grey table of ordering codes.

25.1.1 Bezel assembly

Item	Qty	Ordering code (old) brown	Ordering code (new) grey	Description
1	1	5322 459 20503	5322 381 11119	Bezel
2	1	5322 414 20213	5322 414 60699	Button
3	1	5322 464 90484		Cover
4	1	5322 216 51209		Cursor unit A19
5	1	5322 480 30181		Contrast filter blue
6	1	5322 455 81098	5322 455 81113	Textfilm on bezel PM3350A
	1	5322 455 81099	5322 455 81118	Textfilm on bezel PM3352A
	1	5322 455 71037	5322 455 81127	Textfilm on bezel PM3355
	1	5322 455 71041	5322 455 81129	Textfilm on bezel PM3357

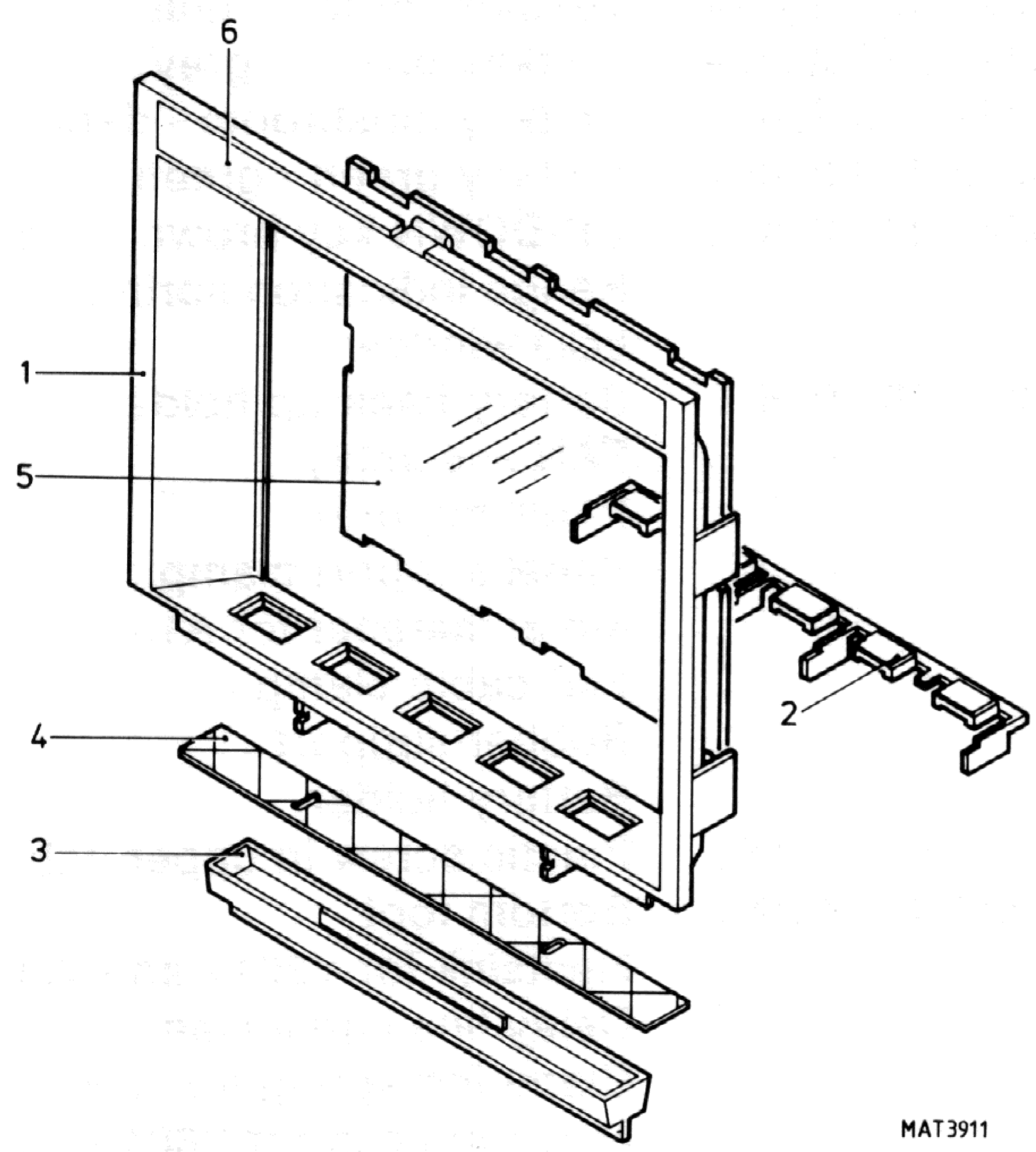


Figure 25.1 Bezel assembly

25.1.2 Mechanical parts indicated in figure 25.2

Item	Qty	Ordering code (old) brown	Ordering code (new) grey	Description
4	1	5322 268 14052		CAL socket
5	1	4822 530 70296		Clamping spring for CAL socket
6	11	5322 414 10018	5322 414 60697	Control knob with spring
7	1	5322 464 90252	5322 464 90659	Front frame
8	1	5322 455 81026	5322 455 81105	Textfilm CRT unit
9	1	5322 455 81097	5322 455 81104	Textfilm for handle PM3350A
9	1	5322 455 71035	5322 455 81104	Textfilm for handle PM3355
10	1	5322 498 50219	5322 498 50308	Handle assembly
10a	2	5322 498 70091		Handle arret
10b	2	5322 529 50203		Spring dowel for handle arret
11	1	5322 414 60142	5322 414 60698	Power-on knob, green-brown
12	2	5322 498 50268		Locking clip for handle
13	1	5322 535 80735		Extension part for power-on switch
14	1	5322 447 91499	5322 447 91801	Upper cabinet for PM3350A/52A
14	1	5322 447 91787	5322 447 91806	Upper cabinet for PM3355/57
15	2	5322 462 10265		P.c.b. guiding for A3
16	2	5322 462 10264		P.c.b. support for A6
17	1	5322 464 90486	5322 464 90661	Chassis
18	6	5322 462 30304		P.c.b. support
19	1	5322 464 90249	5322 447 91802	Bottom cabinet
20	2	5322 447 91487		Attenuator cover
21	1	5322 464 90664		Attenuator chassis
22	3	5322 506 21188		BNC spacer ring
23	3	5322 532 41006		BNC extension bush
24	3	5322 267 10004		BNC socket
25	1	5322 464 90254	5322 256 91632	Front unit frame
26	1	5322 455 81061	5322 455 81114	Textfilm for front unit
27	23	5322 276 11856	5322 276 20489	Softkey brown - grey
28	1	5322 276 12332	5322 276 20493	Softkey mushroom - dark mushroom
29	1	5322 276 11857	5322 276 20492	Softkey green - green
30	5	5322 277 10878	5322 276 20491	UP-DOWN key brown - grey
32	2	5322 492 63354		Range indication spring
33	1	5322 450 60952		LCD window
34	1	5322 256 60289	5322 256 91613	Battery back-up holder
35	1	5322 361 10326		FAN assembly
36	4	5322 462 30377		Panel support
37	4	4822 530 70296		Panel support clamp
38	1	5322 417 20154		Metal fastener for A18
39	2	5322 290 40257		Flat cable clamp
40	2	5322 532 11588		Rubber support
41	2	5322 256 64014		Battery holder
42	3	5322 462 71476	5322 462 41695	Plastic screw in upper cabinet
43	4	5322 462 50325	5322 462 41697	Bottom foot
--	3	5322 255 40054		Heatsink for V3011 and V3012
--	2	5322 401 10954		Delay line cable clamp
--	1	5322 492 70224		Clamping spring for A16
--	2	4822 492 63051		Mounting clip for V6014 and V6016
--	2	5322 255 41133		Isolation foil for V6014 and V6016

ATTENTION: *In some versions of the PM3355/57, the P²CCD unit A18 has been fixed by means of nylon screws, M3x8. Total quantity per instrument is 7. Ordering number: 5322 502 24491.*

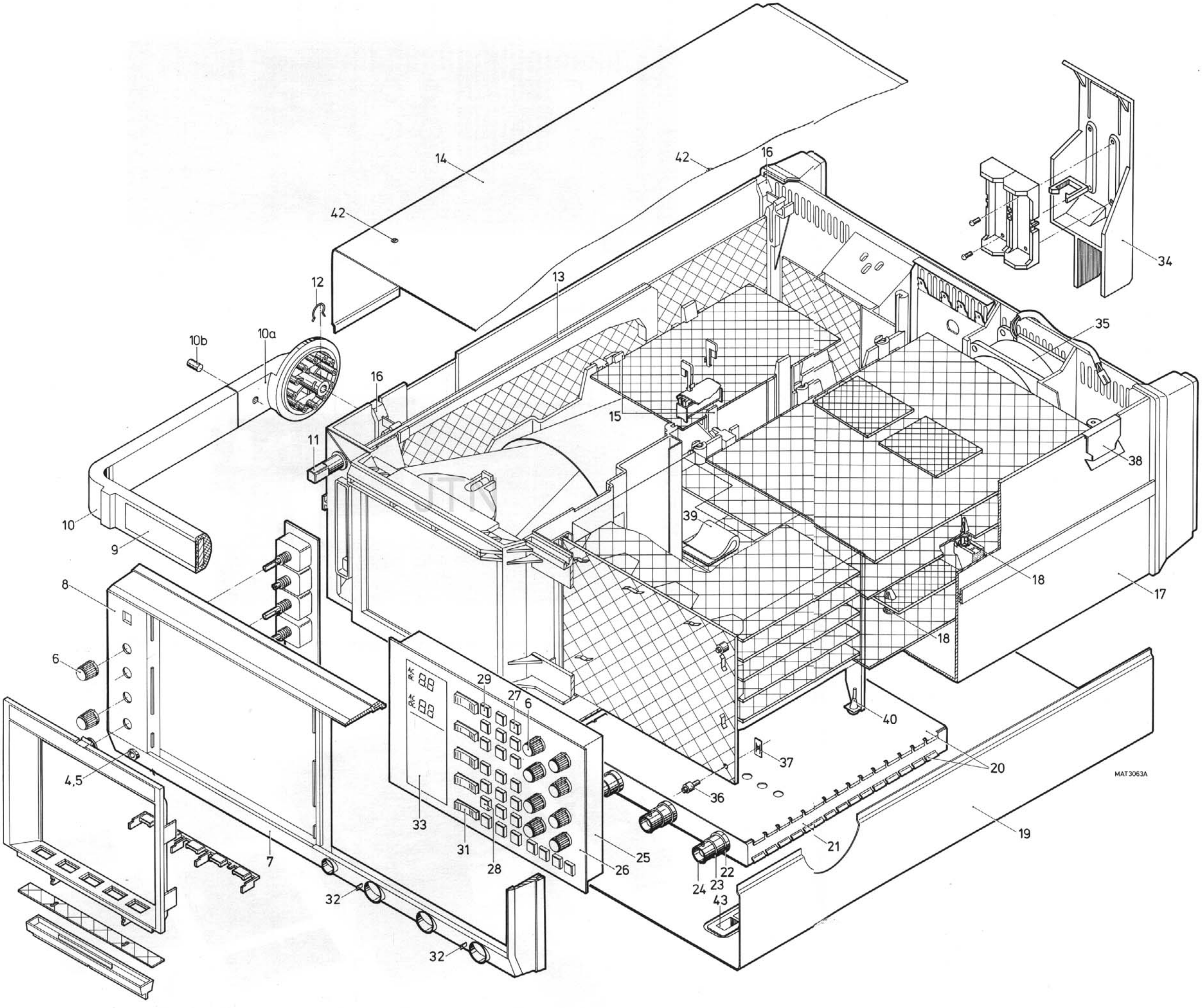


Figure 25.2 Exploded view

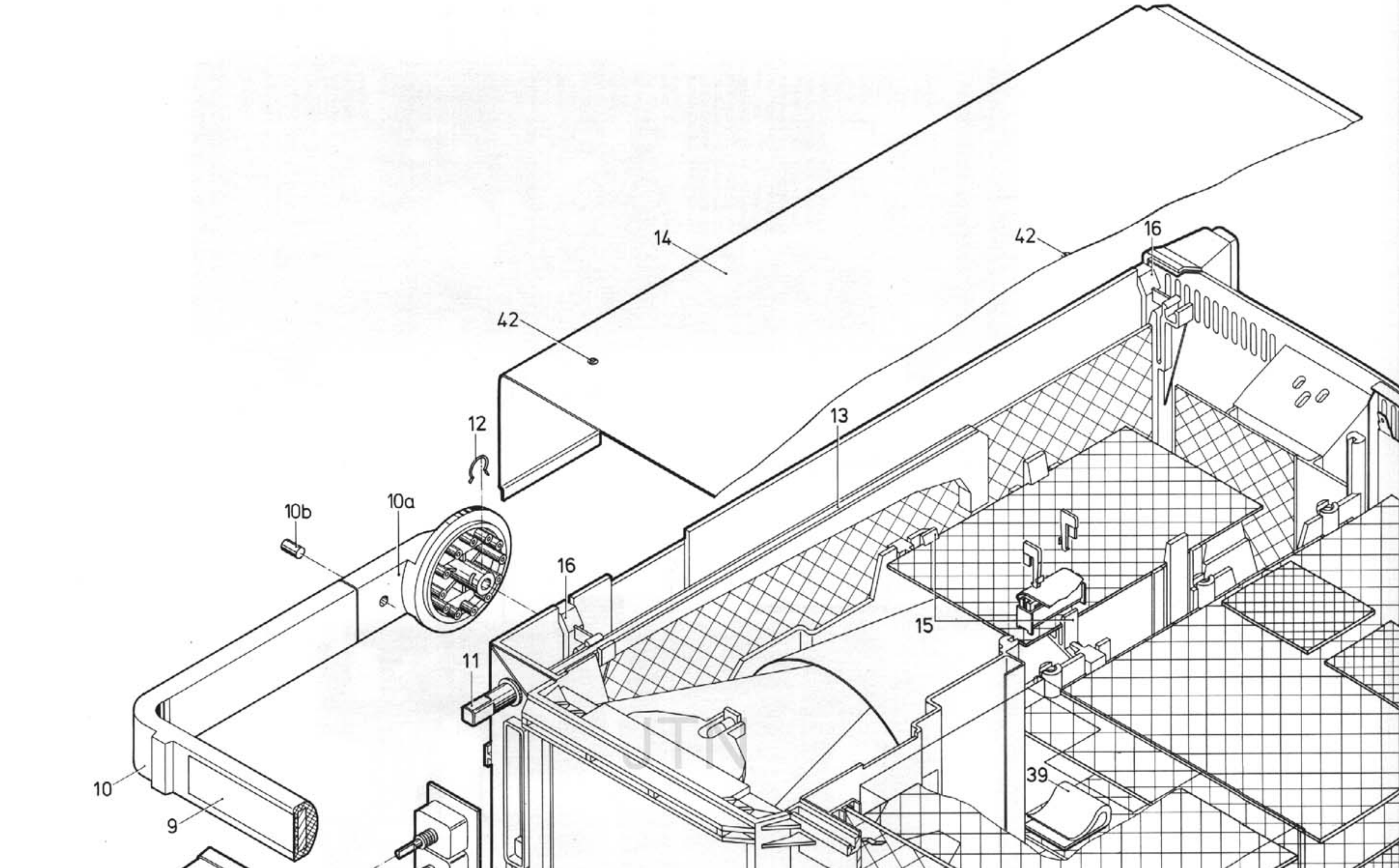
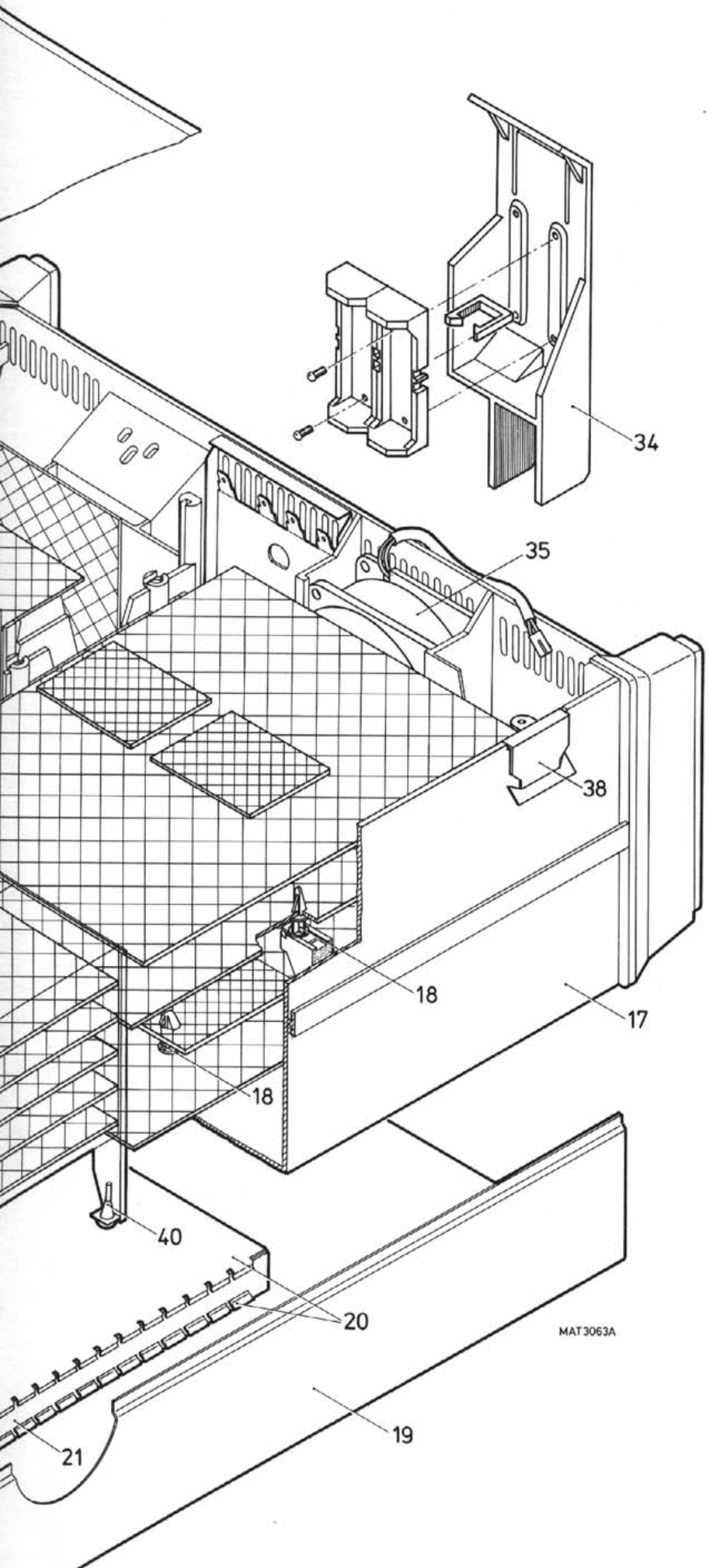


Figure 25.2 Exploded view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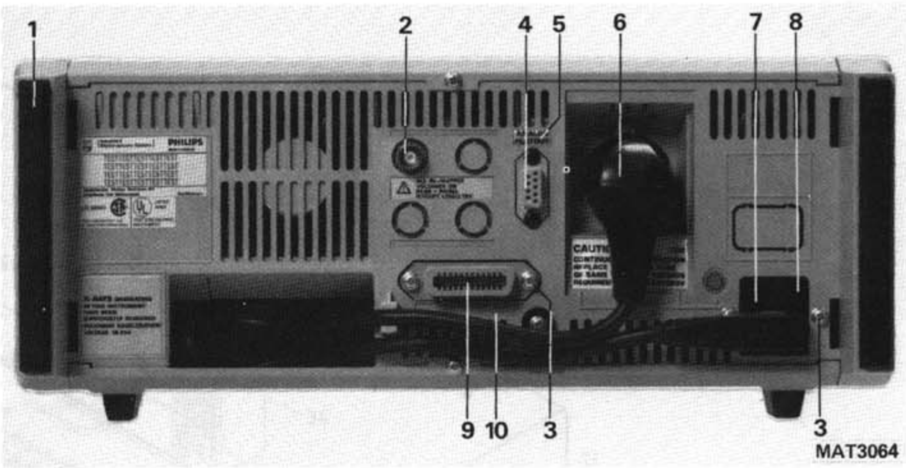

Figure 25.3 Rear view

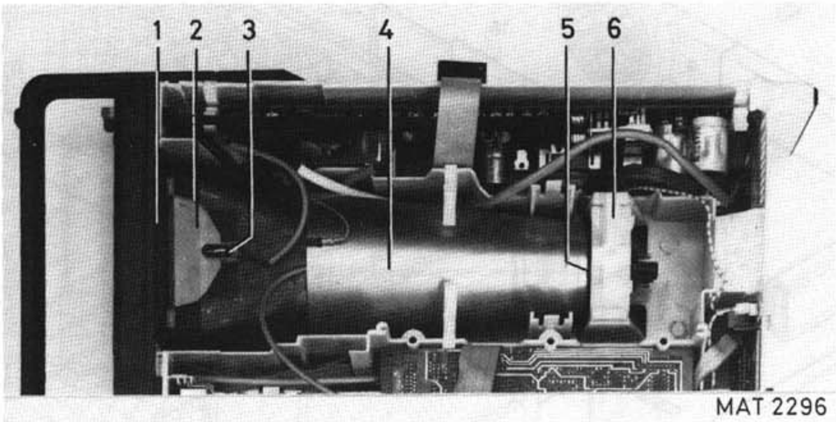

Figure 25.4 Inside view showing the parts in the CRT compartiment

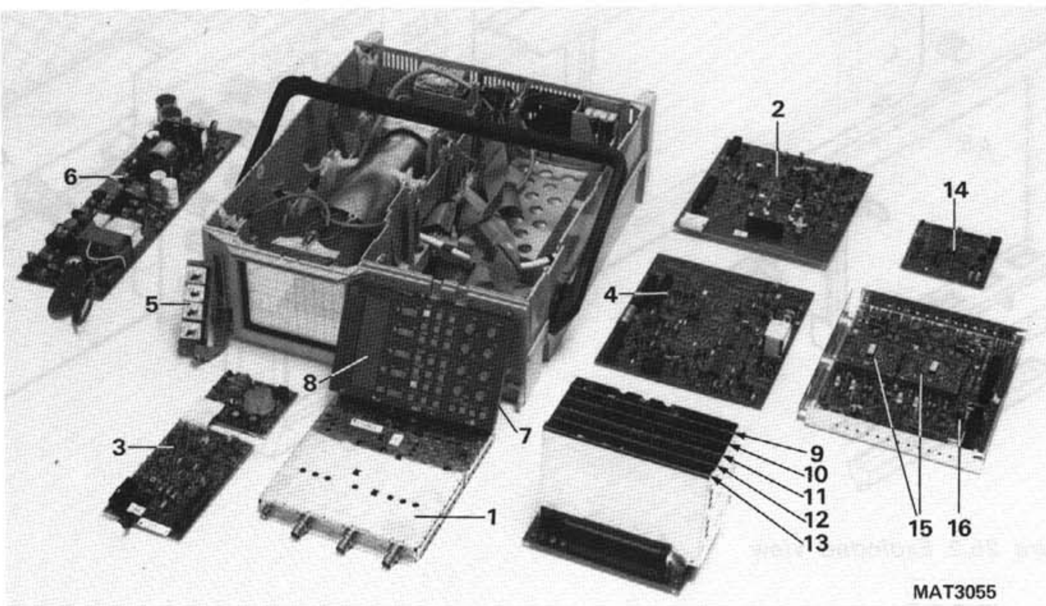

Figure 25.5 View of the units

25.1.3 Mechanical parts indicated in figure 25.3

Item	Qty	Ordering code (old) brown	Ordering code (new) grey	Description
1	2	5322 462 50324	5322 462 41696	Rear foot
2	1	5322 267 10004		BNC socket for Z-MOD
3	4	5322 502 12003		Screws for ANALOG PLOT OUT and Mains input sockets.
4	1	5233 321 22614		Analog plot out socket.
5	1	5322 455 81059		Analog plot out sticker
6	1	5322 321 21616		Line cable, European version
	1	5322 321 10446		Line cable, USA version
	1	5322 321 21617		Line cable, British version
	1	5322 321 21618		Line cable, Swiss version
	1	5322 321 21781		Line cable, Australean version
7	1	5322 219 81119		Mains input socket, incl. fuse holder
8	1	4822 253 30024		Fuse 1,6A (for mains input)

25.1.4 Mechanical parts indicated in figure 25.4

Item	Qty	Ordering code (old) brown	Ordering code (new) grey	Description
1	1	5322 460 60404		CRT front rubber
2	1	5322 462 40957		Light conductor for CRT
3	1	5322 134 40534		Lamp 28V-80mA
4	1	5322 466 30163		CRT shielding
5	1	5322 466 30164		CRT manchet, rubber
6	1	5322 462 10263		CRT support

25.2 UNITS (see figure 25.5)

Item	Unit .	Ordering code (old) brown	Ordering code (new) grey	Description
1	A1	5322 216 51114		Attenuator unit
2	A2	5322 216 51258		Pre-amplifier unit
3	A3	5322 216 51117		XYZ-amplifier unit
4	A4	5322 216 51257		Time-base unit
5	A5	5322 216 51118		CRT-control unit
6	A6	5322 216 51195		Power supply unit
7	A7	5322 216 51197	5322 216 51262	Front unit
8	A8	5322 216 51207		LCD unit
18	A10	5322 216 51252		Motherboard unit
9	A11	5322 216 51198		IEEE-488 unit (optional)
9	A11	5322 216 51212		RS232-C unit (optional)
10	A12	5322 216 51199		CPU unit
11	A13	5322 216 51201		DCL unit
12	A14	5322 216 51202		ACL unit
13	A15	5322 216 51203		ADC-DAC unit
14	A16	5322 216 51204		Adaptation unit
15	A17	5322 216 51205		Mini CCD unit (PM3350A/52A only)
16	A18	5322 216 51206		P^2CCD unit (PM3350A/52A only)
16	A18	5322 216 51255		P^2CCD unit (PM3355/57 only)
17	A19	5322 216 51209		Cursor unit

25.3 CABLES AND CONNECTORS

25.3.1 Flatcables and connectors

For the flatcables used in this oscilloscope, the required version mustbe made by yourself with the following parts:

- Universal flatcable, 40 wires, length 60 cm 5322 323 50112

To get the required number of wires, the flat cable must be split by means of a pair of scissors or a knife.
The cable must be cut to the required length.

- Flatcable connectors

The connectors can be mounted on the flatcable by means of a pair of pliers or in a bench-vice.

ATTENTION: Check the position of the flatcable in the connector before pressing the connector together.

NOTE: The position of all cables and connectors is indicated on Figure 23.8 (p.c.b. interconnections)

The following connectors are available:

Type	Item	Ordering number
6 pole cable connector	X7019	5322 268 40301
10 pole cable connector	X505-X606-X806- X4016-X5007-X6007	5322 268 40234
20 pole cable connector	X91-X803-X2010- X3002-X3003-X4002 X4010-X6009-X7091	5322 268 40235
26 pole cable connector	X102-X1009-X2009	5322 267 70175
34 pole cable connector	X96(X97)-X2001-X4001	5322 268 40236
40 pole cable connector	X98-X808	5322 267 70227

The following AMP-connectors are available:

2 pole-single, without contact pins	5322 268 40232
3 pole-single, without contact pins	5322 268 40233
bus contact for AMP-cable connector, per piece:	5322 268 20152
5 pole connector for power-in:	5322 267 50452
bus contact for connector, per piece:	5322 268 24128

The flatcables are fixed onto the p.c.b. connectors by means of flatcable connector clamps, per piece 5322 401 11156

25.3.2 P.c.b.-connectors (male headers)

Type	Item	Ordering number
2 pole-single	X414-X416-X4017-X6020	5322 265 20275
2 pole-single 90° type	X2013	5322 265 20445
3 pole-single	X6008-X6021	5322 265 30434
3-pole-single	X6018	5322 265 40435
3 pole single	X7011-X7012	5322 265 30396
3 pole-single	X8011-X8012	5322 267 40667
3 pole-single 90° type	X2004-X3004-X3005-X3008-X5218	5322 265 30433
5 pole-single	X6014	5322 265 40436
6 pole-single	X7013	5322 265 30591
8 pole-single	X2021-X2022-X2023 X2024	5322 267 50786
8 pole-single	X1621-X1622-X1623 X1624	5322 265 40483
10 pole-double	X99-X606-X806-X1699-X4016-X5007-X6007-X5206	5322 265 40485
10 pole-double 90° type	X505-X1606	5322 265 61212
20 pole-double	X91-X803-X2010-X3002-X3003-X3009-X3010-X4002-X4010-X5203-X6003-X7009	5322 265 51129
20 pole-double 90° type	X7001	5322 265 51286
26 pole-double	X102-X1009-X2009	5322 265 61071
34 pole-double	X96-X97-X2001-X4001	5322 265 61069
40 pole-double	X98-X808-X5208	5322 265 61211

25.3.3 50 Ω cables and connectors

The 50 Ω coax-cables are standerdized, so some cables are a little bit too long. The tules around the cable end might have the wrong colour, but if necessary it can be replaced by the original one.

- Cable, 30 cm long, 90° type 5322 321 22617
- Cable, 45 cm long 5322 321 22616

The 50 Ω coax-connector socket consists of two parts, bush and pin.

- Outer part (bush) 5322 268 24116
- Inner part (pin) 5322 268 14141

25.3.4 Miscellaneous cables

- Delay line cable, 54 cm long 5322 321 21595
- Flex jump cable, used for interconnection for A3 - 11 pole. 5322 290 60605

25.3.5 Miscellaneous sockets and connectors

CRT socket	5322 255 40502
p.c.b. socket, 96 pole, triple	5322 267 70167
p.c.b. connector, 96 pole, triple	5322 265 61188
Socket for D314	5322 255 40677
Socket for D801	5322 255 41124
Socket for D214, 48 pins	5322 255 40851
Socket for D216, 32 pins	5322 255 40829
p.c.b. socket, 8 pole (X621, X622, X623, X624)	5322 265 40483
p.c.b. socket, 8 pole (X2021, X2022, X2023, X2024)	5322 267 50786

25.4 ELECTRICAL PARTS

The item numbers of the electrical components have been divided into groups which relate to the circuits and the printed-circuit boards.
A survey of this numbering is given in the following table:

Item number	Unit no	Printed-circuit board
1000-1599	A1	Attenuator unit
2000-2999	A2	Pre-amplifier unit
3000-3999	A3	XYZ amplifier unit
4000-4999	A4	Time-base unit
5000-5099	A5	CRT control unit
6000-6999	A6	Power supply unit
7000-7999	A7	Front unit
8000-8999	A8	LCD unit
200- 299	A12	CPU unit
300- 399	A13	DCL unit
400- 499	A14	ACL unit
500- 599	A15	ADC DAC unit
600-699	A16	Adaptation unit
700- 799	A17	Mini CCD (PM3350A/52A only)
800- 999	A18	P^2CCD unit
5100-5999	A18	P^2CCD unit (PM3355/57 only)

25.4.1 CAPACITORS

POSNR	DESCRIPTION			ORDERING CODE
C 0201	CAP.ELECTROLYT.	-10+50%	33UF	4822 124 20712
C 0202	CAP.ELECTROLYT.	-10+50%	33UF	4822 124 20712
C 0203	CAP.FOIL	63V 10%	220NF	4822 121 42408
C 0204	CAP.FOIL	63V 10%	100NF	5322 121 42492
C 0205	CAP.ELECTROLYT.	-10+50%	33UF	4822 124 20712
C 0206	CAP.CERAMIC	2%	100PF	4822 122 31316
C 0207	CAP.CERAMIC	2%	100PF	4822 122 31316
C 0208	CAP.CERAMIC	2%	100PF	4822 122 31316
C 0209	CAP.CERAMIC	2%	100PF	4822 122 31316
C 0251	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 0252	CAP.ELECTROLYT.	-10+50%	220UF	4822 124 20681
C 0253	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 0254	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 0256	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 0257	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 0258	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 0259	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 0261	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 0262	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 0263	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 0264	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 0266	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 0267	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 0268	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 0269	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 0271	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 0272	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 0273	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 0274	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 0276	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 0277	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 0278	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 0279	CAP.FOIL	63V 10%	100NF	5322 121 42492
C 0281	CAP.ELECTROLYT.	-10+50%	100UF	4822 124 20679
C 0282	CAP.ELECTROLYT.	-10+50%	100UF	4822 124 20679
C 0283	CAP.ELECTROLYT.	-10+50%	100UF	4822 124 20679
C 0284	CAP.ELECTROLYT.	-10+50%	100UF	4822 124 20679
C 0301	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 0302	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 0303	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 0304	CAP.FOIL	63V 10%	220NF	4822 121 42408
C 0306	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 0307	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 0308	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 0309	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 0311	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 0312	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 0313	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 0314	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 0316	CAP.ELECTROLYT.	-10+50%	220UF	4822 124 20681
C 0317	CAP.FOIL	63V 10%	100NF	5322 121 42492
C 0318	CAP.ELECTROLYT.	-10+50%	100UF	4822 124 20679
C 0319	CAP.CERAMIC	-20+50%	10NF	4822 122 31414

POSNR	DESCRIPTION			ORDERING CODE
C 0321	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 0322	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 0323	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 0324	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 0326	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 0401	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 0402	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 0403	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 0404	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 0406	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 0407	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 0408	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 0409	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 0411	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 0412	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 0413	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 0414	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 0416	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 0417	CAP.ELECTROLYT.	-10+50%	220UF	4822 124 20681
C 0418	CAP.FOIL	63V 10%	100NF	5322 121 42492
C 0419	CAP.CERAMIC	2%	82PF	4822 122 31237
C 0421	CAP.ELECTROLYT.	-10+50%	100UF	4822 124 20679
C 0422	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 0423	CAP.CERAMIC	2%	82PF	4822 122 31237
C 0428	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 0429	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 0431	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 0432	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 0433	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 0434	CAP.CERAMIC	2%	82PF	4822 122 31237
C 0436	CAP.CERAMIC	-20+50%	6.8NF	4822 122 31429
C 0437	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 0438	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 0439	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 0441	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 0442	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 0511	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 0512	CAP.FOIL	63V 10%	100NF	5322 121 42492
C 0513	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 0514	CAP.FOIL	63V 10%	100NF	5322 121 42492
C 0517	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 0519	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 0521	CAP.FOIL	630V 1%	470PF	5322 121 50999
C 0522	CAP.FOIL	630V 1%	470PF	5322 121 50999
C 0523	CAP.CERAMIC	10%	2.2NF	4822 122 30114
C 0524	CAP.CERAMIC	10%	1NF	4822 122 30027
C 0526	CAP.CERAMIC	10%	2.2NF	4822 122 30114
C 0527	CAP.CERAMIC	10%	1NF	4822 122 30027
C 0528	CAP.CERAMIC	0.25PF	5.6PF	5322 122 32163
C 0531	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 0532	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 0533	CAP.FOIL	63V 10%	100NF	5322 121 42492
C 0534	CAP.FOIL	63V 10%	100NF	5322 121 42492
C 0535	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 0536	CAP.FOIL	63V 10%	100NF	5322 121 42492
C 0538	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 0539	CAP.CERAMIC	2%	47PF	4822 122 31072
C 0541	CAP.CERAMIC	-20+50%	10NF	4822 122 31414

POSNR	DESCRIPTION				ORDERING CODE
C 0542	CAP.ELECTROLYT.		-10+50%	68UF	4822 124 20689
C 0543	CAP.CERAMIC		-20+50%	10NF	4822 122 31414
C 0544	CAP.CERAMIC		-20+50%	10NF	4822 122 31414
C 0546	CAP.CERAMIC		-20+50%	10NF	4822 122 31414
C 0547	CAP.CERAMIC		-20+50%	10NF	4822 122 31414
C 0548	CAP.CERAMIC		-20+50%	10NF	4822 122 31414
C 0549	CAP.ELECTROLYT.		-10+50%	68UF	4822 124 20689
C 0551	CAP.CERAMIC		-20+50%	10NF	4822 122 31414
C 0552	CAP.CERAMIC		-20+50%	10NF	4822 122 31414
C 0553	CAP.CERAMIC		-20+50%	10NF	4822 122 31414
C 0554	CAP.CERAMIC		-20+50%	10NF	4822 122 31414
C 0555	CAP.CERAMIC		-20+50%	10NF	4822 122 31414
C 0556	CAP.CERAMIC		-20+50%	10NF	4822 122 31414
C 0557	CAP.ELECTROLYT.		-10+50%	47UF	4822 124 20699
C 0558	CAP.CERAMIC		-20+50%	10NF	4822 122 31414
C 0559	CAP.ELECTROLYT.		-10+50%	150UF	4822 124 20672
C 0561	CAP.CERAMIC		-20+50%	10NF	4822 122 31414
C 0562	CAP.CERAMIC		-20+50%	10NF	4822 122 31414
C 0563	CAP.CERAMIC		-20+50%	10NF	4822 122 31414
C 0564	CAP.CERAMIC		-20+50%	10NF	4822 122 31414
C 0565	CAP.ELECTROLYT.		-10+50%	47UF	4822 124 20699
C 0571	CAP.CERAMIC		-20+50%	10NF	4822 122 31414
C 0572	CAP.FOIL		63V 10%	100NF	5322 121 42492
C 0573	CAP.CERAMIC		-20+50%	10NF	4822 122 31414
C 0574	CAP.FOIL		63V 10%	100NF	5322 121 42492
C 0576	CAP.CERAMIC		2%	10PF	4822 122 32185
C 0591	CAP.CERAMIC		-20+50%	10NF	4822 122 31414
C 0592	CAP.FOIL		250V 1%	1.5NF	4822 121 42729
C 0593	CAP.CERAMIC		-20+50%	10NF	4822 122 31414
C 0594	CAP.CHIP		2%	15PF	4822 122 31823
C 0596	CAP.		100V 10%	10NF	4822 121 41857
C 0597	CAP.CERAMIC		10%	1NF	4822 122 30027
C 0601	CAP.CERAMIC		-20+50%	10NF	4822 122 31414
C 0601	CAP.CERAMIC		-20+50%	10NF	4822 122 31414
C 0602	CAP.CERAMIC		-20+50%	10NF	4822 122 31414
C 0602	CAP.CERAMIC		-20+50%	10NF	4822 122 31414
C 0603	CAP.CERAMIC		-20+50%	10NF	4822 122 31414
C 0604	CAP.CERAMIC		10%	470PF	4822 122 30034
C 0605	CAP.CERAMIC		10%	1.5NF	4822 122 31169
C 0606	CAP.CERAMIC		10%	1.5NF	4822 122 31169
C 0607	CAP.CERAMIC		-20+50%	10NF	4822 122 31414
C 0608	CAP.CERAMIC		-20+50%	10NF	4822 122 31414
C 0681	CAP.ELECTROLYT.		-10+50%	47UF	4822 124 20699
C 0682	CAP.CERAMIC		-20+50%	10NF	4822 122 31414
C 0683	CAP.ELECTROLYT.		-10+50%	47UF	4822 124 20699
C 0684	CAP.CERAMIC		-20+50%	10NF	4822 122 31414
C 0689	CAP.CERAMIC		-20+50%	10NF	4822 122 31414
C 0691	CAP.CERAMIC		-20+50%	10NF	4822 122 31414
C 0692	CAP.CERAMIC		-20+50%	10NF	4822 122 31414
C 0693	CAP.CERAMIC		-20+50%	10NF	4822 122 31414
C 0701	CAP.CERAMIC	V	0.5PF	8.2PF	5322 122 33244
C 0702	CAP.CHIP	V	10%	22NF	5322 122 32654
C 0703	CAP.CERAMIC	V	0.5PF	8.2PF	5322 122 33244
C 0704	CAP.CHIP	V	10%	22NF	5322 122 32654
C 0705	CAP.CERAMIC	V	5%	18PF	5322 122 32965
C 0706	CAP.CHIP	V	10%	22NF	5322 122 32654
C 0707	CAP.CHIP	V	10%	22NF	5322 122 32654
C 0721	CAP.CHIP	V	10%	22NF	5322 122 32654
C 0722	CAP.CHIP	V	10%	22NF	5322 122 32654
C 0723	CAP.CHIP	V	10%	22NF	5322 122 32654
C 0724	CAP.CHIP	V	10%	22NF	5322 122 32654
C 0725	CAP.CHIP	V	10%	22NF	5322 122 32654
C 0731	CAP.CHIP	V	10%	22NF	5322 122 32654
C 0732	CAP.CHIP	V	10%	22NF	5322 122 32654
C 0733	CAP.CHIP	V	10%	22NF	5322 122 32654
C 0734	CAP.CHIP	V	10%	22NF	5322 122 32654
C 0736	CAP.CHIP	V	10%	22NF	5322 122 32654
C 0737	CAP.CHIP	V	10%	22NF	5322 122 32654
C 0738	CAP.CHIP	V	10%	22NF	5322 122 32654
C 0739	CAP.CHIP	V	10%	22NF	5322 122 32654
C 0741	CAP.CHIP	V	5%	100PF	5322 122 32531
C 0761	CAP.CHIP	V	10%	22NF	5322 122 32654
C 0763	CAP.CHIP	V	10%	22NF	5322 122 32654
C 0764	CAP.CHIP	V	10%	22NF	5322 122 32654
C 0766	CAP.CHIP	V	10%	22NF	5322 122 32654
C 0767	CAP.CHIP	V	10%	22NF	5322 122 32654
C 0768	CAP.CHIP	V	10%	22NF	5322 122 32654
C 0769	CAP.CHIP	V	10%	22NF	5322 122 32654
C 0770	CAP.CHIP	V	10%	22NF	5322 122 32654
C 0771	CAP.CHIP	V	5%	100PF	5322 122 32531
C 0791	CAP.CHIP	V	10%	22NF	5322 122 32654
C 0792	CAP.CHIP	V	10%	22NF	5322 122 32654
C 0793	CAP.CHIP	V	10%	22NF	5322 122 32654
C 0794	CAP.CHIP	V	10%	22NF	5322 122 32654
C 0796	CAP.CHIP	V	10%	22NF	5322 122 32654
C 0802	CAP.CERAMIC		-20+50%	10NF	4822 122 31414
C 0804	CAP.CERAMIC		-20+50%	10NF	4822 122 31414
C 0809	CAP.CERAMIC		-20+50%	10NF	4822 122 31414
C 0810	CAP.CERAMIC		0.25PF	2.2PF	4822 122 31036
C 0811	CAP.ELECTROLYT.		-10+50%	100UF	4822 124 20679
C 0817	CAP.CERAMIC		-20+50%	10NF	4822 122 31414
C 0818	CAP.CERAMIC		2%	12PF	4822 122 31056
C 0819	CAP.CERAMIC		-20+50%	10NF	4822 122 31414
C 0823	CAP.CERAMIC		-20+50%	10NF	4822 122 31414
C 0824	CAP.CERAMIC		2%	12PF	4822 122 31056
C 0825	CAP.CERAMIC		-20+50%	10NF	4822 122 31414
C 0826	CAP.ELECTROLYT.		-10+50%	100UF	4822 124 20679
C 0832	CAP.CERAMIC		-20+50%	10NF	4822 122 31414
C 0834	CAP.CERAMIC		-20+50%	10NF	4822 122 31414
C 0835	CAP.ELECTROLYT.		-10+50%	100UF	4822 124 20679
C 0836	CAP.CERAMIC		0.25PF	2.2PF	4822 122 31036
C 0839	CAP.CERAMIC		-20+50%	10NF	4822 122 31414
C 0847	CAP.CERAMIC		-20+50%	10NF	4822 122 31414
C 0848	CAP.CERAMIC		2%	12PF	4822 122 31056
C 0849	CAP.CERAMIC		-20+50%	10NF	4822 122 31414
C 0851	CAP.ELECTROLYT.		-10+50%	100UF	4822 124 20679
C 0853	CAP.CERAMIC		-20+50%	10NF	4822 122 31414
C 0854	CAP.CERAMIC		2%	12PF	4822 122 31056
C 0855	CAP.CERAMIC		-20+50%	10NF	4822 122 31414
C 0861	CAP.CERAMIC		-20+50%	10NF	4822 122 31414
C 0862	CAP.CERAMIC		10%	1NF	4822 122 30027
C 0865	CAP.CERAMIC		2%	12PF	4822 122 31056

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C 0866	CAP.CERAMIC	2%	33PF		5322 122 32072
C 0869	CAP.CERAMIC	10%	1NF		4822 122 30027
C 0871	CAP.CERAMIC	10%	470PF		4822 122 30034
C 0872	CAP.CERAMIC	-20+50%	10NF		4822 122 31414
C 0874	CAP.CERAMIC	10%	1NF		4822 122 30027
C 0875	CAP.CERAMIC	2%	100PF		4822 122 31316
C 0883	CAP.ELECTROLYT.	-10+50%	150UF		4822 124 20672
C 0884	CAP.ELECTROLYT.	-10+50%	150UF		4822 124 20672
C 0895	CAP.CERAMIC	-20+50%	10NF		4822 122 31414
C 0896	CAP.CERAMIC	-20+50%	10NF		4822 122 31414
C 0898	CAP.ELECTROLYT.	-10+50%	47UF		4822 124 20699
C 0899	CAP.CERAMIC	-20+50%	10NF		4822 122 31414
C 0901	CAP.	100V 10%	22NF		4822 121 41856
C 0903	CAP.CERAMIC	2%	82PF		4822 122 31237
C 0904	CAP.FOIL	220PF 1%		400V	4822 121 51555
C 0906	CAP.	100V 10%	22NF		4822 121 41856
C 0908	CAP.CERAMIC	2%	82PF		4822 122 31237
C 0909	CAP.FOIL	220PF 1%		400V	4822 121 51555
C 0911	CAP.	100V 10%	22NF		4822 121 41856
C 0913	CAP.CERAMIC	2%	82PF		4822 122 31237
C 0914	CAP.FOIL	220PF 1%		400V	4822 121 51555
C 0916	CAP.	100V 10%	22NF		4822 121 41856
C 0918	CAP.CERAMIC	2%	82PF		4822 122 31237
C 0919	CAP.FOIL	220PF 1%		400V	4822 121 51555
C 0920	CAP.CERAMIC	-20+50%	10NF		4822 122 31414
C 0921	CAP.ELECTROLYT.	-10+50%	100UF		4822 124 20679
C 0922	CAP.CERAMIC	-20+50%	10NF		4822 122 31414
C 0923	CAP.CERAMIC	-20+50%	10NF		4822 122 31414
C 0924	CAP.CERAMIC	-20+50%	10NF		4822 122 31414
C 0925	CAP.CERAMIC	-20+50%	10NF		4822 122 31414
C 0926	CAP.CERAMIC	-20+50%	10NF		4822 122 31414
C 0927	CAP.CERAMIC	-20+50%	10NF		4822 122 31414
C 0928	CAP.CERAMIC	-20+50%	10NF		4822 122 31414
C 0929	CAP.CERAMIC	-20+50%	10NF		4822 122 31414
C 0930	CAP.CERAMIC	-20+50%	10NF		4822 122 31414
C 0931	CAP.CERAMIC	-20+50%	10NF		4822 122 31414
C 0932	CAP.CERAMIC	-20+50%	10NF		4822 122 31414
C 0933	CAP.CERAMIC	-20+50%	10NF		4822 122 31414
C 0934	CAP.CERAMIC	-20+50%	10NF		4822 122 31414
C 0935	CAP.CERAMIC	-20+50%	10NF		4822 122 31414
C 0936	CAP.CERAMIC	-20+50%	10NF		4822 122 31414
C 0937	CAP.CERAMIC	-20+50%	10NF		4822 122 31414
C 0938	CAP.CERAMIC	-20+50%	10NF		4822 122 31414
C 0939	CAP.CERAMIC	-20+50%	10NF		4822 122 31414
C 0942	CAP.CERAMIC	-20+50%	10NF		4822 122 31414
C 0950	CAP.ELECTROLYT.	-10+50%	100UF		4822 124 20679
C 0951	CAP.CERAMIC	-20+50%	10NF		4822 122 31414
C 0952	CAP.CERAMIC	-20+50%	10NF		4822 122 31414
C 0954	CAP.CERAMIC	-20+50%	10NF		4822 122 31414
C 0956	CAP.CERAMIC	-20+50%	10NF		4822 122 31414
C 0957	CAP.CERAMIC	-20+50%	10NF		4822 122 31414
C 0958	CAP.CERAMIC	-20+50%	10NF		4822 122 31414
C 0959	CAP.CERAMIC	-20+50%	10NF		4822 122 31414
C 0960	CAP.CERAMIC	-20+50%	10NF		4822 122 31414
C 0961	CAP.ELECTROLYT.	-10+50%	100UF		4822 124 20679
C 0962	CAP.ELECTROLYT.	-10+50%	150UF		4822 124 20672
C 0963	CAP.ELECTROLYT.	-10+50%	68UF		4822 124 20689
C 0964	CAP.ELECTROLYT.	-10+50%	68UF		4822 124 20689
C 0965	CAP.CERAMIC	-20+50%	10NF		4822 122 31414
C 0968	CAP.CERAMIC	-20+50%	10NF		4822 122 31414
C 0969	CAP.CERAMIC	-20+50%	10NF		4822 122 31414
C 0971	CAP.CERAMIC	-20+50%	10NF		4822 122 31414
C 0972	CAP.CERAMIC	-20+50%	10NF		4822 122 31414
C 0973	CAP.CERAMIC	-20+50%	10NF		4822 122 31414
C 0974	CAP.CERAMIC	-20+50%	10NF		4822 122 31414
C 0976	CAP.ELECTROLYT.	-10+50%	15UF		4822 124 20729
C 0977	CAP.ELECTROLYT.	-10+50%	47UF		4822 124 20699
C 0978	CAP.ELECTROLYT.	-10+50%	68UF		4822 124 20689
C 0979	CAP.ELECTROLYT.	-10+50%	68UF		4822 124 20689
C 0980	CAP.CERAMIC	-20+50%	10NF		4822 122 31414
C 0981	CAP.ELECTROLYT.	-10+50%	33UF		4822 124 20712
C 0982	CAP.CERAMIC	-20+50%	10NF		4822 122 31414
C 0983	CAP.CERAMIC	-20+50%	10NF		4822 122 31414
C 0984	CAP.CERAMIC	-20+50%	10NF		4822 122 31414
C 0985	CAP.CERAMIC	-20+50%	10NF		4822 122 31414
C 0986	CAP.FOIL	63V 10%	100NF		5322 121 42492
C 0987	CAP.ELECTROLYT.	-10+50%	47UF		4822 124 20699
C 0988	CAP.CERAMIC	-20+50%	10NF		4822 122 31414
C 0993	CAP.CERAMIC	-20+50%	10NF		4822 122 31414
C 0995	CAP.ELECTROLYT.	-10+50%	68UF		4822 124 20689
C 0996	CAP.CERAMIC	-20+50%	10NF		4822 122 31414
C 0997	CAP.ELECTROLYT.	-10+50%	150UF		4822 124 20672
C 0999	CAP.CERAMIC	-20+50%	10NF		4822 122 31414
C 1001	CAP.CERAMIC	-20+50%	10NF		4822 122 31414
C 1002	CAP.FOIL	400V 10%	22NF		5322 121 40308
C 1003	CAP.CERAMIC	-20+50%	10NF		4822 122 31414
C 1004	CAP.CERAMIC	-20+50%	10NF		4822 122 31414
C 1006	CAP.CERAMIC	-20+50%	10NF		4822 122 31414
C 1009	CAP.CERAMIC	2%	33PF		5322 122 32072
C 1011	CAP.FOIL	63V 10%	220NF		4822 121 42408
C 1012	CAP.FOIL	63V 10%	220NF		4822 121 42408
C 1013	CAP.CHIP	2%	15PF		4822 122 31823
C 1016	CAP.CERAMIC	0.25PF	3.3PF		5322 122 32549
C 1017	CAP.CHIP	0.25PF	3.3PF		4822 122 31821
C 1018	CAP.CERAMIC	0.25PF	2.7PF		5322 122 32894
C 1019	CAP.CERAMIC	2%	33PF		5322 122 32551
C 1021	CAP.CERAMIC	-20+50%	10NF		4822 122 31414
C 1022	CAP.CERAMIC	2%	22PF		5322 122 32417
C 1023	CAP.VARIABLE	7-10.0 PF	MUR		5322 125 11013
C 1024	CAP.CERAMIC	-20+50%	10NF		4822 122 31414
C 1026	CAP.CERAMIC	0.25PF	3.3PF		5322 122 32549
C 1027	CAP.CERAMIC	0.25PF	2.2PF		5322 122 32774
C 1028	CAP.CERAMIC	2%	33PF		5322 122 32551
C 1029	CAP.VARIABLE	7-10.0 PF	MUR		5322 125 11013
C 1031	CAP.CERAMIC	-20+50%	10NF		4822 122 31414
C 1032	CAP.CERAMIC	2%	33PF		5322 122 32551
C 1033	CAP.VARIABLE	7-10.0 PF	MUR		5322 125 11013
C 1034	CAP.CERAMIC	-20+50%	10NF		4822 122 31414
C 1035	CAP.CERAMIC	-20+50%	10NF		4822 122 31414
C 1036	CAP.CERAMIC	2%	39PF		4822 122 31069
C 1037	CAP.CERAMIC	2%	22PF		5322 122 32143
C 1038	CAP.CERAMIC	2%	100PF		4822 122 31316

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C 1039	CAP.TRIMMER	25-2,3 PF	MUR	5322 125 11021
C 1041	CAP.FOIL	63V 10%	100NF	5322 121 42492
C 1042	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 1043	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 1044	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 1045	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 1046	CAP.ELECTROLYT.	-10+50%	68UF	4822 124 20689
C 1047	CAP.CHIP	0.25PF	4.7PF	4822 122 31822
C 1061	CAP.CERAMIC	10%	470PF	4822 122 30034
C 1062	CAP.CERAMIC	0.25PF	2.2PF	4822 122 31036
C 1063	CAP.CERAMIC	10%	4.7NF	4822 122 31125
C 1064	CAP.CERAMIC	10%	1.5NF	4822 122 31169
C 1067	CAP.CERAMIC	2%	39PF	4822 122 31069
C 1068	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 1071	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 1072	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 1073	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 1074	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 1076	CAP.CERAMIC	10%	1.5NF	4822 122 31169
C 1077	CAP.CERAMIC	10%	1.5NF	4822 122 31169
C 1101	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 1102	CAP.FOIL	400V 10%	22NF	5322 121 40308
C 1103	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 1104	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 1106	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 1109	CAP.CERAMIC	2%	33PF	5322 122 32072
C 1111	CAP.FOIL	63V 10%	220NF	4822 121 42408
C 1112	CAP.FOIL	63V 10%	220NF	4822 121 42408
C 1113	CAP.CHIP	2%	15PF	4822 122 31823
C 1116	CAP.CERAMIC	0.25PF	3.3PF	5322 122 32549
C 1117	CAP.CHIP	0.25PF	3.3PF	4822 122 31821
C 1118	CAP.CERAMIC	0.25PF	2.7PF	5322 122 32894
C 1119	CAP.CERAMIC	2%	33PF	5322 122 32551
C 1121	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 1122	CAP.CERAMIC	2%	33PF	5322 122 32551
C 1123	CAP.VARIABLE	7-10.0 PF	MUR	5322 125 11013
C 1124	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 1126	CAP.CERAMIC	0.25PF	3.3PF	5322 122 32549
C 1127	CAP.CERAMIC	0.25PF	2.2PF	5322 122 32774
C 1128	CAP.CERAMIC	2%	33PF	5322 122 32551
C 1129	CAP.VARIABLE	7-10.0 PF	MUR	5322 125 11013
C 1131	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 1132	CAP.CERAMIC	2%	33PF	5322 122 32551
C 1133	CAP.VARIABLE	7-10.0 PF	MUR	5322 125 11013
C 1134	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 1135	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 1136	CAP.CERAMIC	2%	39PF	4822 122 31069
C 1137	CAP.CERAMIC	2%	22PF	5322 122 32143
C 1138	CAP.CERAMIC	2%	100PF	4822 122 31316
C 1139	CAP.CERAMIC	0.25PF	2.2PF	4822 122 31036
C 1141	CAP.FOIL	63V 10%	100NF	5322 121 42492
C 1142	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 1143	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 1144	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 1145	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 1146	CAP.ELECTROLYT.	-10+50%	68UF	4822 124 20689
C 1147	CAP.CHIP	0.25PF	4.7PF	4822 122 31822
C 1161	CAP.CERAMIC	10%	470PF	4822 122 30034
C 1162	CAP.CERAMIC	0.25PF	2.2PF	4822 122 31036
C 1163	CAP.CERAMIC	10%	4.7NF	4822 122 31125
C 1164	CAP.CERAMIC	10%	1.5NF	4822 122 31169
C 1167	CAP.CERAMIC	2%	39PF	4822 122 31069
C 1168	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 1171	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 1172	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 1173	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 1174	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 1176	CAP.CERAMIC	10%	1.5NF	4822 122 31169
C 1177	CAP.CERAMIC	10%	1.5NF	4822 122 31169
C 1201	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 1202	CAP.FOIL	400V 10%	22NF	5322 121 40308
C 1203	CAP.CERAMIC	2%	33PF	5322 122 32551
C 1204	CAP.CERAMIC	0.25PF	3.9PF	4822 122 31217
C 1206	CAP.VARIABLE	7-10.0 PF	MUR	5322 125 11013
C 1207	CAP.CERAMIC	2%	22PF	5322 122 32143
C 1208	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 1210	CAP.CERAMIC	0.25PF	2.2PF	4822 122 31036
C 1211	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 1212	CAP.CERAMIC	2%	100PF	4822 122 31316
C 1216	CAP.CERAMIC	2%	12PF	4822 122 31056
C 1217	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 1401	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 1402	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 1403	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 1404	CAP.ELECTROLYT.	-10+50%	68UF	4822 124 20689
C 1405	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 1407	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 1408	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 1409	CAP.ELECTROLYT.	-10+50%	68UF	4822 124 20689
C 1411	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 1412	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 1413	CAP.ELECTROLYT.	-10+50%	47UF	4822 124 20699
C 1414	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 1420	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 1421	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 1422	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 1423	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 1424	CAP.ELECTROLYT.	-10+50%	68UF	4822 124 20689
C 1427	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 1428	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 1429	CAP.ELECTROLYT.	-10+50%	68UF	4822 124 20689
C 1431	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 1432	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 1433	CAP.ELECTROLYT.	-10+50%	47UF	4822 124 20699
C 1434	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 1441	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 1442	CAP.ELECTROLYT.	-10+50%	68UF	4822 124 20689
C 1443	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 1444	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 1446	CAP.ELECTROLYT.	-10+50%	68UF	4822 124 20689
C 1447	CAP.CERAMIC	-20+50%	10NF	4822 122 31414

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C 2049	CAP.CERAMIC	10%	1.5NF	4822 122 31169
C 2050	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 2051	CAP.CERAMIC	10%	1.5NF	4822 122 31169
C 2052	CAP.CERAMIC	0.25PF	1.5PF	5322 122 32101
C 2149	CAP.CERAMIC	10%	1.5NF	4822 122 31169
C 2150	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 2151	CAP.CERAMIC	10%	1.5NF	4822 122 31169
C 2201	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 2203	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 2215	CAP.CERAMIC	0.25PF	6.8PF	4822 122 31049
C 2216	CAP.CERAMIC	0.25PF	2.7PF	4822 122 31038
C 2217	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 2218	CAP.CERAMIC	0.25PF	2.7PF	4822 122 31038
C 2220	CAP.CERAMIC	2%	10PF	4822 122 32185
C 2221	CAP.CERAMIC	10%	1.5NF	4822 122 31169
C 2222	CAP.CERAMIC	0.25PF	8.2PF	4822 122 31052
C 2223	CAP.CERAMIC	10%	1.5NF	4822 122 31169
C 2224	CAP.CERAMIC	10%	1.5NF	4822 122 31169
C 2225	CAP.CERAMIC	10%	470PF	4822 122 30034
C 2226	CAP.CERAMIC	10%	470PF	4822 122 30034
C 2229	CAP.CERAMIC	10%	470PF	4822 122 30034
C 2230	CAP.CERAMIC	10%	470PF	4822 122 30034
C 2305	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 2306	CAP.CERAMIC	10%	1.5NF	4822 122 31169
C 2307	CAP.CERAMIC	10%	1.5NF	4822 122 31169
C 2317	CAP.CHIP	V 0.25PF	1.5PF	5322 126 10225
C 2318	CAP.CHIP	V 5%	470PF	5322 122 32268
C 2321	CAP.CHIP	V 0.25PF	1.5PF	5322 126 10225
C 2326	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 2327	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 2328	CAP.FOIL	63V 10%	100NF	5322 121 42492
C 2329	CAP.FOIL	63V 10%	100NF	5322 121 42492
C 2331	CAP.FOIL	63V 10%	100NF	5322 121 42492
C 2332	CAP.FOIL	63V 10%	100NF	5322 121 42492
C 2333	CAP.FOIL	63V 10%	100NF	5322 121 42492
C 2335	CAP.CERAMIC	2%	12PF	4822 122 31056
C 2336	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 2337	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 2338	CAP.CERAMIC	10%	470PF	4822 122 30034
C 2345	CAP.CERAMIC	0.25PF	01.8PF	5322 122 32313
C 2346	CAP.CERAMIC	10%	1.5NF	4822 122 31169
C 2348	CAP.CERAMIC	10%	1.5NF	4822 122 31169
C 2350	CAP.CERAMIC	0.25PF	2.7PF	4822 122 31038
C 2600	CAP.CERAMIC	2%	22PF	5322 122 32143
C 2601	CAP.FOIL	63V 10%	100NF	5322 121 42492
C 2602	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 2604	CAP.CERAMIC	10%	1.5NF	4822 122 31169
C 2611	CAP.CERAMIC	10%	1NF	4822 122 30027
C 2612	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 2613	CAP.CERAMIC	10%	470PF	4822 122 30034
C 2616	CAP.CERAMIC	10%	470PF	4822 122 30034
C 2701	CAP.ELECTROLYT.	-10+50%	100UF	4822 124 20679
C 2702	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 2703	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 2704	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 2706	CAP.ELECTROLYT.	-10+50%	100UF	4822 124 20679
C 2707	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 2708	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 2709	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 2711	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 2716	CAP.ELECTROLYT.	-10+50%	68UF	4822 124 20689
C 2717	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 2718	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 2722	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 2726	CAP.ELECTROLYT.	-10+50%	68UF	4822 124 20689
C 2727	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 2728	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 2741	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 2744	CAP.CHIP	V 10%	10NF	5322 122 34098
C 2746	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 2747	CAP.ELECTROLYT.	-10+50%	68UF	4822 124 20689
C 2748	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 2751	CAP.ELECTROLYT.	-10+50%	47UF	4822 124 20699
C 2752	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 2753	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 2754	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 2771	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 2772	CAP.ELECTROLYT.	-10+50%	150UF	4822 124 20672
C 2773	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 2774	CAP.ELECTROLYT.	-10+50%	68UF	4822 124 20689
C 2776	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 2777	CAP.FOIL	63V 10%	100NF	5322 121 42492
C 2781	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 2801	CAP.CHIP	V 10%	3.3NF	4822 122 33891
C 2802	CAP.CHIP	V 10%	6.8NF	5322 122 31866
C 2803	CAP.CHIP	V 10%	6.8NF	5322 122 31866
C 2804	CAP.CHIP	V 5%	680PF	4822 122 31775
C 3001	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 3002	CAP.CERAMIC	10%	1.5NF	4822 122 31169
C 3003	CAP.CERAMIC	10%	1.5NF	4822 122 31169
C 3004	CAP.VARIABLE	7-10.0 PF	MUR	5322 125 11013
C 3005	CAP.TRIMMER	2-20PF	MUR	5322 125 50296
C 3007	CAP.VARIABLE	7-10.0 PF	MUR	5322 125 11013
C 3009	CAP.CERAMIC	2%	12PF	4822 122 31056
C 3011	CAP.CERAMIC	2%	68PF	4822 122 31349
C 3013	CAP.CERAMIC	0.25PF	2.7PF	4822 122 31038
C 3014	CAP.CERAMIC	0.25PF	2.7PF	4822 122 31038
C 3016	CAP.TRIMMER	2-20PF	MUR	5322 125 50296
C 3017	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 3018	CAP.CERAMIC	0.25PF	5.6PF	5322 122 32163
C 3021	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 3022	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 3101	CAP.CERAMIC	10%	1.5NF	4822 122 31169
C 3102	CAP.CERAMIC	10%	1.5NF	4822 122 31169
C 3104	CAP.FOIL	100V 10%	47NF	5322 121 42491
C 3105	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 3106	CAP.FOIL	63V 10%	100NF	5322 121 42492
C 3107	CAP.CERAMIC	0.25PF	2.7PF	4822 122 31038
C 3108	CAP.CERAMIC	0.25PF	0.82PF	4822 122 31214
C 3109	CAP.FOIL	63V 10%	100NF	5322 121 42492
C 3110	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 3111	CAP.CERAMIC	-20+50%	10NF	4822 122 31414

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C 3112	CAP.CERAMIC	0.25PF	3.9PF	5322 122 34107
C 3113	CAP.CERAMIC	0.25PF	0.82PF	4822 122 31214
C 3114	CAP.FOIL	100V 10%	47NF	5322 121 42491
C 3116	CAP.FOIL	63V 10%	100NF	5322 121 42492
C 3200	CAP.CERAMIC	0.25PF	0.56PF	5322 122 32107
C 3201	CAP.CERAMIC	0.25PF	0.56PF	5322 122 32107
C 3202	CAP.FOIL	63V 10%	100NF	5322 121 42492
C 3203	CAP.FOIL	63V 10%	100NF	5322 121 42492
C 3204	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 3206	CAP.FOIL	63V 10%	100NF	5322 121 42492
C 3208	CAP.CERAMIC	10%	470PF	4822 122 30034
C 3209	CAP.	-10+10%	2.2NF	5322 122 33851
C 3211	CAP.	-10+10%	2.2NF	5322 122 33851
C 3250	CAP.	100V 10%	10NF	4822 121 41857
C 3251	CAP.FOIL	63V 10%	220NF	4822 121 42408
C 3252	CAP.	-10+10%	2.2NF	5322 122 33851
C 3253	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 3254	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 3256	CAP.CERAMIC	0.25PF	0.56PF	5322 122 32107
C 3257	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 3258	CAP.	-10+10%	2.2NF	5322 122 33851
C 3301	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 3302	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 3303	CAP.ELECTROLYT.	-10+50%	47UF	4822 124 20699
C 3304	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 3306	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 3307	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 3308	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 3309	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 3311	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 3312	CAP.ELECTROLYT.	-10+50%	47UF	4822 124 20699
C 3313	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 3314	CAP.ELECTROLYT.	-10+50%	15UF	4822 124 20729
C 3316	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 3317	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 3318	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 3319	CAP.ELECTROLYT.	-10+50%	15UF	4822 124 20729
C 3321	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 3322	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 3324	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 3326	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 4001	CAP.CERAMIC	2%	100PF	4822 122 31316
C 4002	CAP.CERAMIC	2%	100PF	4822 122 31316
C 4003	CAP.	100V 10%	10NF	4822 121 41857
C 4004	CAP.CERAMIC	10%	4.7NF	4822 122 31125
C 4005	CAP.CERAMIC	10%	4.7NF	4822 122 31125
C 4006	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 4007	CAP.CERAMIC	10%	470PF	4822 122 30034
C 4011	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 4028	CAP.CERAMIC	2%	100PF	4822 122 31316
C 4029	CAP.CERAMIC	2%	100PF	4822 122 31316
C 4101	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 4103	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 4105	CAP.FOIL	63V 10%	100NF	5322 121 42492
C 4106	CAP.ELECTROLYT.	-10+50%	150UF	4822 124 20672
C 4107	CAP.FOIL	63V 10%	100NF	5322 121 42492
C 4108	CAP.CERAMIC	2%	100PF	4822 122 31316
C 4109	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 4110	CAP.FOIL	63V 10%	470NF	5322 121 42979
C 4112	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 4113	CAP.FOIL	630V 1%	1NF	4822 121 50591
C 4114	CAP.FOIL	100V 10%	10UF	5322 121 41727
C 4116	CAP.CERAMIC	10%	1.5NF	4822 122 31169
C 4117	CAP.CERAMIC	2%	100PF	4822 122 31316
C 4118	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 4120	CAP.FOIL	63V 10%	100NF	5322 121 42492
C 4122	CAP.FOIL	63V 10%	100NF	5322 121 42492
C 4123	CAP.ELECTROLYT.	-10+50%	47UF	4822 124 20699
C 4124	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 4126	CAP.ELECTROLYT.	-10+50%	47UF	4822 124 20699
C 4260	CAP.FOIL	63V 10%	100NF	5322 121 42492
C 4301	CAP.FOIL	63V 10%	100NF	5322 121 42492
C 4302	CAP.ELECTROLYT.	-10+50%	4.7UF	4822 124 20726
C 4303	CAP.	100V 10%	10NF	4822 121 41857
C 4304	CAP.CERAMIC	2%	220PF	4822 122 30094
C 4306	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 4307	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 4311	CAP.CERAMIC	2%	100PF	4822 122 31316
C 4501	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 4502	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 4503	CAP.CERAMIC	0.25PF	3.9PF	5322 122 34107
C 4521	CAP.FOIL	63V 10%	100NF	5322 121 42492
C 4522	CAP.FOIL	63V 10%	100NF	5322 121 42492
C 4601	CAP.FOIL	63V 10%	100NF	5322 121 42492
C 4602	CAP.CERAMIC	0.25PF	8.2PF	4822 122 31052
C 4603	CAP.CERAMIC	0.25PF	8.2PF	4822 122 31052
C 4611	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 4612	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 4613	CAP.CERAMIC	2%	10PF	4822 122 32185
C 4701	CAP.CERAMIC	10%	1NF	4822 122 30027
C 4702	CAP.CERAMIC	2%	220PF	4822 122 30094
C 4703	CAP.CERAMIC	10%	1NF	4822 122 30027
C 4704	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 4801	CAP.CERAMIC	-20+20%	2200UF	4822 124 21382
C 4804	CAP.ELECTROLYT.	-10+50%	150UF	4822 124 20672
C 4807	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 4808	CAP.ELECTROLYT.	-10+50%	68UF	4822 124 20689
C 4811	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 4815	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 4819	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 4820	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 4822	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 4825	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 4829	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 4831	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 4832	CAP.ELECTROLYT.	-10+50%	47UF	4822 124 20699
C 4833	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 4835	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 4836	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 4837	CAP.ELECTROLYT.	-10+50%	47UF	4822 124 20699
C 4839	CAP.CERAMIC	2%	12PF	4822 122 31056
C 4888	CAP.ELECTROLYT.	-10+50%	47UF	4822 124 20699
C 4889	CAP.ELECTROLYT.	-10+50%	47UF	4822 124 20699
C 4891	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 4893	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 4895	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 4897	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 4898	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 4899	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 5001	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 5002	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 5003	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 5004	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 5006	CAP.CERAMIC	-20+50%	10NF	4822 122 31414
C 5101	CAP.CHIP	V 10%	22NF	5322 122 32654
C 5102	CAP.CHIP	V 10%	22NF	5322 122 32654
C 5103	CAP.CHIP	V 5%	15PF	5322 122 33869
C 5104	CAP.CHIP	V 5%	33PF	5322 122 32659
C 5105	CAP.CERAMIC	V 0.25PF	1.8PF	5322 126 10343
C 5106	CAP.CHIP	V 10%	22NF	5322 122 32654
C 5111	CAP.CHIP	V 10%	22NF	5322 122 32654
C 5112	CAP.CHIP	V 10%	22NF	5322 122 32654
C 5113	CAP.CERAMIC	V 5%	10PF	5322 122 32448
C 5114	CAP.CHIP	V 5%	27PF	5322 122 31946
C 5115	CAP.CERAMIC	V 0.25PF	1.8PF	5322 126 10343
C 5116	CAP.CHIP	V 10%	22NF	5322 122 32654
C 5121	CAP.CHIP	V 10%	1.5NF	4822 122 33174
C 5122	CAP.CHIP	V 10%	22NF	5322 122 32654
C 5123	CAP.CERAMIC	V +-0.5PF	6.8PF	5322 126 10728
C 5124	CAP.CERAMIC	V +-0.5PF	6.8PF	5322 126 10728
C 5126	CAP.CERAMIC	V 0.5PF	5.6PF	5322 122 32967
C 5127	CAP.TRIMMER	63V	2.5-5PF	5322 125 50305
C 5128	CAP.TRIMMER	63V	3.5-10PF	5322 125 50306
C 5129	CAP.CHIP	V 10%	22NF	5322 122 32654
C 5130	CAP.	16V	10UF	5322 124 41979
C 5131	CAP.CHIP	V 10%	22NF	5322 122 32654
C 5132	CAP.CHIP	V 10%	22NF	5322 122 32654
C 5133	CAP.CHIP	V 10%	22NF	5322 122 32654
C 5134	CAP.CHIP	V 10%	22NF	5322 122 32654
C 5136	CAP.CHIP	V 10%	22NF	5322 122 32654
C 5137	CAP.CHIP	V 5%	15PF	5322 122 33869
C 5138	CAP.CHIP	V 5%	100PF	5322 122 32531
C 5139	CAP.CHIP	V 5%	820PF	5322 126 10184
C 5141	CAP.CHIP	V 10%	22NF	5322 122 32654
C 5142	CAP.CHIP	V 10%	22NF	5322 122 32654
C 5143	CAP.CHIP	V 10%	22NF	5322 122 32654
C 5144	CAP.	16V	10UF	5322 124 41979
C 5202	CAP.CHIP	V 10%	22NF	5322 122 32654
C 5203	CAP.CHIP	V 10%	22NF	5322 122 32654
C 5204	CAP.CHIP	V 10%	1.5NF	4822 122 33174
C 5206	CAP.CHIP	V 10%	1.5NF	4822 122 33174
C 5211	CAP.CERAMIC	V 5%	47PF	5322 122 32452
C 5212	CAP.CHIP	V 10%	22NF	5322 122 32654
C 5214	CAP.CERAMIC	V 5%	47PF	5322 122 32452
C 5221	CAP.CHIP	V 10%	22NF	5322 122 32654
C 5222	CAP.CHIP	V 10%	22NF	5322 122 32654
C 5223	CAP.CHIP	V 10%	22NF	5322 122 32654
C 5224	CAP.CHIP	V 10%	22NF	5322 122 32654
C 5226	CAP.CHIP	V 10%	22NF	5322 122 32654
C 5227	CAP.CHIP	V 10%	22NF	5322 122 32654
C 5228	CAP.CHIP	V 10%	22NF	5322 122 32654
C 5229	CAP.CHIP	V 10%	22NF	5322 122 32654
C 5251	CAP.CHIP	V 10%	22NF	5322 122 32654
C 5261	CAP.CHIP	V 10%	22NF	5322 122 32654
C 5262	CAP.CHIP	V 10%	22NF	5322 122 32654
C 5272	CAP.CHIP	V 10%	22NF	5322 122 32654
C 5273	CAP.CHIP	V 10%	22NF	5322 122 32654
C 5276	CAP.CHIP	V 10%	22NF	5322 122 32654
C 5277	CAP.CHIP	V 10%	22NF	5322 122 32654
C 5278	CAP.CHIP	V 10%	22NF	5322 122 32654
C 5301	CAP.CHIP	V 10%	22NF	5322 122 32654
C 5303	CAP.CHIP	V 10%	22NF	5322 122 32654
C 5304	CAP.	16V	10UF	5322 124 41979
C 5306	CAP.CHIP	V 10%	22NF	5322 122 32654
C 5307	CAP.	16V	10UF	5322 124 41979
C 5308	CAP.CHIP	V 10%	22NF	5322 122 32654
C 5351	CAP.CHIP	V 10%	22NF	5322 122 32654
C 5353	CAP.CHIP	V 10%	22NF	5322 122 32654
C 5354	CAP.CHIP	V 10%	22NF	5322 122 32654
C 5356	CAP.CHIP	V 10%	22NF	5322 122 32654
C 5357	CAP.	16V	10UF	5322 124 41979
C 5358	CAP.CHIP	V 10%	22NF	5322 122 32654
C 5359	CAP.	16V	10UF	5322 124 41979
C 5361	CAP.CHIP	V 10%	22NF	5322 122 32654
C 5362	CAP.	16V	10UF	5322 124 41979
C 5363	CAP.CHIP	V 10%	22NF	5322 122 32654
C 5374	CAP.CERAMIC	V 0.5PF	5.6PF	5322 122 32967
C 5377	CAP.CERAMIC	V 0.5PF	5.6PF	5322 122 32967
C 5401	CAP.CHIP	V 10%	22NF	5322 122 32654
C 5403	CAP.CHIP	V 10%	22NF	5322 122 32654
C 5404	CAP.	16V	10UF	5322 124 41979
C 5406	CAP.CHIP	V 10%	22NF	5322 122 32654
C 5407	CAP.	16V	10UF	5322 124 41979
C 5408	CAP.CHIP	V 10%	22NF	5322 122 32654
C 5451	CAP.CHIP	V 10%	22NF	5322 122 32654
C 5453	CAP.CHIP	V 10%	22NF	5322 122 32654
C 5454	CAP.CHIP	V 10%	22NF	5322 122 32654
C 5456	CAP.CHIP	V 10%	22NF	5322 122 32654
C 5457	CAP.	16V	10UF	5322 124 41979
C 5458	CAP.CHIP	V 10%	22NF	5322 122 32654
C 5459	CAP.	16V	10UF	5322 124 41979
C 5461	CAP.CHIP	V 10%	22NF	5322 122 32654
C 5462	CAP.	16V	10UF	5322 124 41979
C 5463	CAP.CHIP	V 10%	22NF	5322 122 32654
C 5474	CAP.CERAMIC	V 0.5PF	5.6PF	5322 122 32967
C 5477	CAP.CERAMIC	V 0.5PF	5.6PF	5322 122 32967
C 5501	CAP.CHIP	V 0.5PF	6.8PF	5322 122 32269
C 5502	CAP.CHIP	V 10%	22NF	5322 122 32654
C 5503	CAP.CERAMIC	V 0.25PF	2.7PF	5322 122 31873
C 5504	CAP.CERAMIC	V 0.25PF	2.7PF	5322 122 31873
C 5506	CAP.CHIP	V 10%	22NF	5322 122 32654
C 5507	CAP.CHIP	V 10%	22NF	5322 122 32654
C 5508	CAP.CERAMIC	V 0.5PF	5.6PF	5322 122 32967

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C 5509	CAP.CHIP	V	10%	22NF		5322 122 32654
C 5511	CAP.CHIP	V	10%	22NF		5322 122 32654
C 5512	CAP.CHIP	V	10%	10NF		5322 122 34098
C 5513	CAP.CHIP	V	10%	22NF		5322 122 32654
C 5551	CAP.CHIP	V	0.5PF	6.8PF		5322 122 32269
C 5552	CAP.CHIP	V	10%	22NF		5322 122 32654
C 5553	CAP.CERAMIC	V	0.25PF	2.7PF		5322 122 31873
C 5554	CAP.CERAMIC	V	0.25PF	2.7PF		5322 122 31873
C 5556	CAP.CHIP	V	10%	22NF		5322 122 32654
C 5557	CAP.CHIP	V	10%	22NF		5322 122 32654
C 5558	CAP.CERAMIC	V	0.5PF	5.6PF		5322 122 32967
C 5559	CAP.CHIP	V	10%	22NF		5322 122 32654
C 5561	CAP.CHIP	V	10%	22NF		5322 122 32654
C 5562	CAP.CHIP	V	10%	10NF		5322 122 34098
C 5563	CAP.CHIP	V	10%	22NF		5322 122 32654
C 5581	CAP.CHIP	V	10%	22NF		5322 122 32654
C 5582	CAP.CHIP	V	10%	22NF		5322 122 32654
C 5601	CAP.	16V		10UF		5322 124 41979
C 5602	CAP.CHIP	V	10%	22NF		5322 122 32654
C 5603	CAP.CHIP	V	10%	22NF		5322 122 32654
C 5604	CAP.CHIP	V	10%	22NF		5322 122 32654
C 5606	CAP.CHIP	V	10%	22NF		5322 122 32654
C 5607	CAP.CHIP	V	10%	22NF		5322 122 32654
C 5608	CAP.CHIP	V	10%	22NF		5322 122 32654
C 5609	CAP.CHIP	V	10%	22NF		5322 122 32654
C 5611	CAP.CHIP	V	10%	22NF		5322 122 32654
C 5612	CAP.CHIP	V	10%	22NF		5322 122 32654
C 5613	CAP.CHIP	V	10%	22NF		5322 122 32654
C 5614	CAP.CHIP	V	10%	22NF		5322 122 32654
C 5651	CAP.CHIP	V	10%	22NF		5322 122 32654
C 5652	CAP.CHIP	V	10%	22NF		5322 122 32654
C 5653	CAP.CHIP	V	10%	22NF		5322 122 32654
C 5654	CAP.CHIP	V	10%	22NF		5322 122 32654
C 5656	CAP.CHIP	V	10%	22NF		5322 122 32654
C 5671	CAP.CHIP	V	5%	100PF		5322 122 32531
C 5672	CAP.CHIP	V	5%	100PF		5322 122 32531
C 5691	CAP.CHIP	V	10%	22NF		5322 122 32654
C 5692	CAP.CHIP	V	10%	22NF		5322 122 32654
C 5693	CAP.CHIP	V	10%	22NF		5322 122 32654
C 5694	CAP.CHIP	V	10%	22NF		5322 122 32654
C 5702	CAP.CHIP	V	10%	22NF		5322 122 32654
C 5703	CAP.CHIP	V	10%	22NF		5322 122 32654
C 5704	CAP.CHIP	V	10%	22NF		5322 122 32654
C 5706	CAP.CHIP	V	10%	22NF		5322 122 32654
C 5707	CAP.CHIP	V	10%	22NF		5322 122 32654
C 5708	CAP.CHIP	V	10%	22NF		5322 122 32654
C 5709	CAP.CHIP	V	10%	22NF		5322 122 32654
C 5711	CAP.CHIP	V	10%	22NF		5322 122 32654
C 5712	CAP.CHIP	V	10%	22NF		5322 122 32654
C 5713	CAP.CHIP	V	10%	22NF		5322 122 32654
C 5714	CAP.CHIP	V	10%	22NF		5322 122 32654
C 5751	CAP.CHIP	V	10%	22NF		5322 122 32654
C 5752	CAP.CHIP	V	10%	22NF		5322 122 32654
C 5753	CAP.CHIP	V	10%	22NF		5322 122 32654
C 5754	CAP.CHIP	V	10%	22NF		5322 122 32654
C 5756	CAP.CHIP	V	10%	22NF		5322 122 32654
C 5771	CAP.CHIP	V	5%	100PF		5322 122 32531
C 5772	CAP.CHIP	V	5%	100PF		5322 122 32531
C 5791	CAP.CHIP	V	10%	22NF		5322 122 32654
C 5792	CAP.CHIP	V	10%	22NF		5322 122 32654
C 5793	CAP.CHIP	V	10%	22NF		5322 122 32654
C 5794	CAP.CHIP	V	10%	22NF		5322 122 32654
C 5801	CAP.CHIP	V	10%	22NF		5322 122 32654
C 5802	CAP.CHIP	V	10%	22NF		5322 122 32654
C 5803	CAP.CHIP	V	5%	82PF		4822 122 33515
C 5804	CAP.FOIL	220PF	1%		400V	4822 121 51555
C 5806	CAP.CHIP	V	10%	22NF		5322 122 32654
C 5807	CAP.CHIP	V	10%	22NF		5322 122 32654
C 5808	CAP.CHIP	V	5%	82PF		4822 122 33515
C 5809	CAP.FOIL	220PF	1%		400V	4822 121 51555
C 5811	CAP.CHIP	V	10%	22NF		5322 122 32654
C 5812	CAP.CHIP	V	10%	22NF		5322 122 32654
C 5813	CAP.CHIP	V	5%	82PF		4822 122 33515
C 5814	CAP.FOIL	220PF	1%		400V	4822 121 51555
C 5816	CAP.CHIP	V	10%	22NF		5322 122 32654
C 5817	CAP.CHIP	V	10%	22NF		5322 122 32654
C 5818	CAP.CHIP	V	5%	82PF		4822 122 33515
C 5819	CAP.FOIL	220PF	1%		400V	4822 121 51555
C 5832	CAP.CHIP	V	10%	22NF		5322 122 32654
C 5841	CAP.CHIP	V	10%	22NF		5322 122 32654
C 5895	CAP.CHIP	V	10%	22NF		5322 122 32654
C 5898	CAP.ELECTROLYT.		-10+50%	47UF		4822 124 20699
C 5899	CAP.CHIP	V	10%	22NF		5322 122 32654
C 5901	CAP.ELECTROLYT.		-10+50%	100UF		4822 124 20679
C 5902	CAP.	16V		10UF		5322 124 41979
C 5903	CAP.	16V		10UF		5322 124 41979
C 5904	CAP.CHIP	V	10%	22NF		5322 122 32654
C 5906	CAP.	16V		10UF		5322 124 41979
C 5907	CAP.	16V		10UF		5322 124 41979
C 5908	CAP.CHIP	V	10%	22NF		5322 122 32654
C 5909	CAP.CHIP	V	10%	22NF		5322 122 32654
C 5911	CAP.ELECTROLYT.		-10+50%	33UF		4822 124 20712
C 5912	CAP.CHIP	V	10%	22NF		5322 122 32654
C 5913	CAP.CHIP	V	10%	22NF		5322 122 32654
C 5914	CAP.CHIP	V	10%	22NF		5322 122 32654
C 5916	CAP.ELECTROLYT.		-10+50%	47UF		4822 124 20699
C 5917	CAP.CHIP	V	10%	22NF		5322 122 32654
C 5918	CAP.ELECTROLYT.		-10+50%	15UF		4822 124 20729
C 5922	CAP.ELECTROLYT.		-10+50%	47UF		4822 124 20699
C 5923	CAP.CHIP	V	10%	22NF		5322 122 32654
C 5927	CAP.ELECTROLYT.		-10+50%	68UF		4822 124 20689
C 5928	CAP.CHIP	V	10%	22NF		5322 122 32654
C 5929	CAP.CHIP	V	10%	22NF		5322 122 32654
C 5931	CAP.CHIP	V	10%	22NF		5322 122 32654
C 5932	CAP.CHIP	V	10%	22NF		5322 122 32654
C 5933	CAP.CHIP	V	10%	22NF		5322 122 32654
C 5934	CAP.CHIP	V	10%	22NF		5322 122 32654
C 5936	CAP.CHIP	V	10%	22NF		5322 122 32654
C 5937	CAP.CHIP	V	10%	22NF		5322 122 32654
C 5938	CAP.CHIP	V	10%	22NF		5322 122 32654
C 5939	CAP.CHIP	V	10%	22NF		5322 122 32654
C 5943	CAP.ELECTROLYT.		-10+50%	68UF		4822 124 20689

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C 5944	CAP.CHIP	V	10%	22NF	5322 122 32654
C 5946	CAP.CHIP	V	10%	22NF	5322 122 32654
C 5947	CAP.CHIP	V	10%	22NF	5322 122 32654
C 5948	CAP.CHIP	V	10%	22NF	5322 122 32654
C 5949	CAP.CHIP	V	10%	22NF	5322 122 32654
C 5951	CAP.CHIP	V	10%	22NF	5322 122 32654
C 5952	CAP.CHIP	V	10%	22NF	5322 122 32654
C 5953	CAP.ELECTROLYT.		-10+50%	150UF	4822 124 20672
C 5954	CAP.CHIP	V	10%	22NF	5322 122 32654
C 5956	CAP.CHIP	V	10%	22NF	5322 122 32654
C 5957	CAP.CHIP	V	10%	22NF	5322 122 32654
C 5958	CAP.CHIP	V	10%	22NF	5322 122 32654
C 5959	CAP.CHIP	V	10%	22NF	5322 122 32654
C 5961	CAP.	16V		10UF	5322 124 41979
C 5962	CAP.CHIP	V	10%	22NF	5322 122 32654
C 5963	CAP.CHIP	V	10%	22NF	5322 122 32654
C 5964	CAP.CHIP	V	10%	22NF	5322 122 32654
C 5966	CAP.CHIP	V	10%	22NF	5322 122 32654
C 5967	CAP.CHIP	V	10%	22NF	5322 122 32654
C 5968	CAP.CHIP	V	10%	22NF	5322 122 32654
C 6001	CAP.PAPER	250V	10%	220NF	5322 121 44142
C 6002	CAP.FOIL		-20+20%	1NF	5322 121 43656
C 6003	CAP.FOIL	63V	10%	100NF	5322 121 42492
C 6004	CAP.FOIL	63V	10%	100NF	5322 121 42492
C 6005	CAP.CERAMIC		-20+50%	1.5NF	5322 122 50092
C 6006	CAP.FOIL		-20+20%	1NF	5322 121 43656
C 6007	CAP.ELECTROLYT.		-20+20%	68UF	5322 124 21938
C 6008	CAP.ELECTROLYT.		-20+20%	68UF	5322 124 21938
C 6009	CAP.FOIL	100V	10%	47NF	5322 121 42491
C 6011	CAP.ELECTROLYT.		-10+50%	33UF	4822 124 20712
C 6012	CAP.CERAMIC		2%	220PF	4822 122 30094
C 6013	CAP.CERAMIC		10%	4.7NF	4822 122 31125
C 6014	CAP.FOIL	160V	1%	33NF	5322 121 50997
C 6017	CAP.	2KV	5%	1.5NF	5322 121 43243
C 6018	CAP.CERAMIC		10%	4.7NF	4822 122 31125
C 6031	CAP.	100V	10%	10NF	4822 121 41857
C 6032	CAP.FOIL	63V	10%	220NF	4822 121 42408
C 6033	CAP.	100V	10%	10NF	4822 121 41857
C 6041	CAP.FOIL	63V	10%	100NF	5322 121 42492
C 6042	CAP.FOIL	63V	10%	100NF	5322 121 42492
C 6100	CAP.		20%	6800UF	4822 124 40692
C 6101	CAP.		20%	6800UF	4822 124 40692
C 6102	CAP.ELECTROLYT.		-10+50%	680UF	4822 124 20685
C 6103	CAP.		-20+20%	1000UF	5322 124 23276
C 6104	CAP.		-20+20%	1000UF	5322 124 23276
C 6106	CAP.		-20+20%	1000UF	5322 124 23276
C 6107	CAP.ELECTROLYT.		-10+50%	150UF	4822 124 20691
C 6108	CAP.		-20+20%	1000UF	5322 124 23276
C 6109	CAP.ELECTROLYT.		-10+50%	150UF	4822 124 20691
C 6111	CAP.		-20+20%	1000UF	5322 124 23276
C 6112	CAP.ELECTROLYT.		-10+50%	100UF	4822 124 20701
C 6113	CAP.ELECTROLYT.		-10+50%	100UF	4822 124 20701
C 6114	CAP.ELECTROLYT.		-10+50%	100UF	4822 124 20701
C 6116	CAP.ELECTROLYT.		-10+50%	68UF	4822 124 20734
C 6117	CAP.ELECTROLYT.		-10+50%	22UF	4822 124 20731
C 6119	CAP.ELECTROLYT.		-10+50%	22UF	4822 124 20731
C 6120	CAP.CERAMIC		-20+50%	10NF	4822 122 31414
C 6121	CAP.ELECTROLYT.		-10+50%	22UF	4822 124 20731
C 6122	CAP.FOIL	630V	1%	680PF	5322 121 51214
C 6131	CAP.FOIL	63V	10%	470NF	5322 121 42979
C 6132	CAP.ELECTROLYT.		-10+50%	100UF	4822 124 20679
C 6133	CAP.FOIL	63V	10%	100NF	5322 121 42492
C 6134	CAP.CERAMIC		10%	1NF	4822 122 30027
C 6135	CAP.CERAMIC		-20+50%	10NF	4822 122 31414
C 6201	CAP.FOIL	100V	10%	47NF	5322 121 42491
C 6202	CAP.CERAMIC		2%	47PF	4822 122 31072
C 6203	CAP.FOIL	63V	10%	220NF	4822 121 42408
C 6204	CAP.FOIL	63V	10%	100NF	5322 121 42492
C 6205	CAP.FOIL	63V	10%	100NF	5322 121 42492
C 6206	CAP.CERAMIC		10%	1NF	4822 122 30027
C 6207	CAP.CERAMIC		10%	4.7NF	4822 122 31125
C 6208	CAP.ELECTROLYT.		-10+50%	68UF	4822 124 20734
C 6209	CAP.CERAMIC		-20+50%	2.2NF	5322 122 50093
C 6210	CAP.FOIL	63V	10%	100NF	5322 121 42492
C 6211	CAP.CERAMIC		-20+50%	10NF	5322 122 50091
C 6212	CAP.CERAMIC		-10+10%	33PF	5322 122 33081
C 6213	CAP.CERAMIC		10%	4.7NF	4822 122 31125
C 6214	CAP.CERAMIC		20%	470PF	5322 122 50086
C 6215	CAP.FOIL	63V	10%	100NF	5322 121 42492
C 6311	CAP.CERAMIC		-20+50%	10NF	4822 122 31414
C 6312	CAP.CERAMIC		-20+50%	10NF	4822 122 31414
C 6401	CAP.FOIL	63V	10%	100NF	5322 121 42492
C 6402	CAP.ELECTROLYT.		-10+50%	68UF	4822 124 20689
C 6500	CAP.ELECTROLYT.		-10+50%	68UF	4822 124 20689
C 6501	CAP.CERAMIC		-20+50%	10NF	4822 122 31414
C 6502	CAP.	100V	10%	10NF	4822 121 41857
C 6503	CAP.CERAMIC		2%	100PF	4822 122 31316
C 6506	CAP.CERAMIC		2%	100PF	4822 122 31316
C 7004	CAP.CERAMIC		-20+50%	10NF	4822 122 31414
C 7006	CAP.CERAMIC		-20+50%	10NF	4822 122 31414
C 7007	CAP.FOIL	63V	10%	100NF	5322 121 42492
C 7008	CAP.CERAMIC		10%	680PF	4822 122 30053
C 7009	CAP.FOIL	63V	10%	220NF	4822 121 42408
C 7011	CAP.CERAMIC		-20+50%	10NF	4822 122 31414
C 7012	CAP.CERAMIC		-20+50%	10NF	4822 122 31414
C 7013	CAP.CERAMIC		-20+50%	10NF	4822 122 31414
C 7014	CAP.CERAMIC		-20+50%	10NF	4822 122 31414
C 7016	CAP.CERAMIC		-20+50%	10NF	4822 122 31414
C 7017	CAP.CERAMIC		-20+50%	10NF	4822 122 31414
C 7018	CAP.CERAMIC		-20+50%	10NF	4822 122 31414
C 7019	CAP.CERAMIC		-20+50%	10NF	4822 122 31414
C 7101	CAP.CERAMIC		-20+50%	10NF	4822 122 31414
C 7102	CAP.CERAMIC		-20+50%	10NF	4822 122 31414
C 7103	CAP.CERAMIC		-20+50%	10NF	4822 122 31414
C 7104	CAP.ELECTROLYT.		-10+50%	100UF	4822 124 20679
C 7106	CAP.CERAMIC		-20+50%	10NF	4822 122 31414
C 7107	CAP.CERAMIC		-20+50%	10NF	4822 122 31414
C 7108	CAP.CERAMIC		-20+50%	10NF	4822 122 31414
C 7109	CAP.CERAMIC		-20+50%	10NF	4822 122 31414
C 7111	CAP.CERAMIC		-20+50%	10NF	4822 122 31414
C 7112	CAP.CERAMIC		-20+50%	10NF	4822 122 31414
C 7114	CAP.ELECTROLYT.		-10+50%	33UF	4822 124 20712
C 7116	CAP.CERAMIC		-20+50%	10NF	4822 122 31414
C 7117	CAP.CERAMIC		-20+50%	10NF	4822 122 31414

25.4.2 RESISTORS

POSNR	DESCRIPTION				ORDERING CODE
R 0200	RES.METAL FILM	MRS25	1%	10K	4822 116 53022
R 0201	RES.METAL FILM	MRS25	1%	100K	4822 050 21004
R 0202	RES.METAL FILM	MRS25	1%	10K	4822 116 53022
R 0203	RES.METAL FILM	MRS25	1%	100K	4822 050 21004
R 0204	RES.METAL FILM	MRS25	1%	10K	4822 116 53022
R 0206	RES.METAL FILM	MRS25	1%	11K	4822 116 52907
R 0207	RES.METAL FILM	MRS25	1%	10K	4822 116 53022
R 0208	RES.METAL FILM	MRS25	1%	1K	4822 116 53108
R 0209	RES.METAL FILM	MRS25	1%	90K9	5322 116 53582
R 0211	RES.METAL FILM	MRS25	1%	1K	4822 116 53108
R 0212	RES.METAL FILM	MRS25	1%	46K4	5322 116 53314
R 0213	RES.METAL FILM	MRS25	1%	3K16	4822 116 53021
R 0214	RES.METAL FILM	MRS25	1%	46K4	5322 116 53314
R 0216	RES.METAL FILM	MRS25	1%	2K15	5322 116 53239
R 0217	RES.METAL FILM	MRS25	1%	10K	4822 116 53022
R 0218	RES.METAL FILM	MRS25	1%	10K	4822 116 53022
R 0219	RES.METAL FILM	MRS25	1%	10K	4822 116 53022
R 0220	RES.METAL FILM	MRS25	1%	2K15	5322 116 53239
R 0221	RES.METAL FILM	MRS25	1%	3K16	4822 116 53021
R 0222	RES.METAL FILM	MRS25	1%	3K16	4822 116 53021
R 0223	RES.METAL FILM	MRS25	1%	3K16	4822 116 53021
R 0224	RES.METAL FILM	MRS25	1%	3K16	4822 116 53021
R 0226	RES.METAL FILM	MRS25	1%	51E1	5322 116 53213
R 0227	RES.METAL FILM	MRS25	1%	51E1	5322 116 53213
R 0228	RES.METAL FILM	MRS25	1%	10K	4822 116 53022
R 0229	RES.METAL FILM	MRS25	1%	51E1	5322 116 53213
R 0232	RES.METAL FILM	MRS25	1%	1E	4822 050 21008
R 0233	RES.METAL FILM	MRS25	1%	1E	4822 050 21008
R 0234	RES.METAL FILM	MRS25	1%	1E	4822 050 21008
R 0251	RES.METAL FILM	MRS25	1%	10E	4822 116 52891
R 0252	RES.METAL FILM	MRS25	1%	51E1	5322 116 53213
R 0301	RES.METAL FILM	MRS25	1%	100E	5322 116 53126
R 0302	RES.METAL FILM	MRS25	1%	100E	5322 116 53126
R 0303	RES.METAL FILM	MRS25	1%	100E	5322 116 53126
R 0304	RES.METAL FILM	MRS25	1%	1K33	5322 116 53512
R 0306	RES.METAL FILM	MRS25	1%	1K33	5322 116 53512
R 0307	RES.METAL FILM	MRS25	1%	1K33	5322 116 53512
R 0309	RES.METAL FILM	MRS25	1%	10K	4822 116 53022
R 0312	RES.METAL FILM	MRS25	1%	2K15	5322 116 53239
R 0313	RES.METAL FILM	MRS25	1%	100K	4822 050 21004
R 0321	RES.METAL FILM	MRS25	1%	100E	5322 116 53126
R 0322	RES.METAL FILM	MRS25	1%	100E	5322 116 53126
R 0323	RES.METAL FILM	MRS25	1%	100E	5322 116 53126
R 0401	RES.METAL FILM	MRS25	1%	100E	5322 116 53126
R 0402	RES.METAL FILM	MRS25	1%	100E	5322 116 53126
R 0403	RES.METAL FILM	MRS25	1%	100E	5322 116 53126
R 0404	RES.METAL FILM	MRS25	1%	100E	5322 116 53126
R 0406	RES.METAL FILM	MRS25	1%	100E	5322 116 53126
R 0407	RES.METAL FILM	MRS25	1%	100E	5322 116 53126
R 0408	RES.METAL FILM	MRS25	1%	100E	5322 116 53126
R 0409	RES.METAL FILM	MRS25	1%	100E	5322 116 53126
R 0411	RES.METAL FILM	MRS25	1%	100E	5322 116 53126
R 0412	RES.METAL FILM	MRS25	1%	100E	5322 116 53126
R 0413	RES.METAL FILM	MRS25	1%	100E	5322 116 53126
R 0414	RES.METAL FILM	MRS25	1%	100E	5322 116 53126
R 0416	RES.METAL FILM	MRS25	1%	100E	5322 116 53126
R 0417	RES.METAL FILM	MRS25	1%	100E	5322 116 53126
R 0418	RES.METAL FILM	MRS25	1%	422E	5322 116 53592
R 0419	RES.METAL FILM	MRS25	1%	422E	5322 116 53592
R 0421	RES.METAL FILM	MRS25	1%	422E	5322 116 53592
R 0422	RES.METAL FILM	MRS25	1%	100E	5322 116 53126
R 0423	RES.METAL FILM	MRS25	1%	422E	5322 116 53592
R 0424	RES.METAL FILM	MRS25	1%	422E	5322 116 53592
R 0426	RES.METAL FILM	MRS25	1%	422E	5322 116 53592
R 0427	RES.METAL FILM	MRS25	1%	100E	5322 116 53126
R 0429	RES.METAL FILM	MRS25	1%	1K	4822 116 53108
R 0431	RES.METAL FILM	MRS25	1%	10K	4822 116 53022
R 0433	RES.METAL FILM	MRS25	1%	10K	4822 116 53022
R 0434	RES.METAL FILM	MRS25	1%	100E	5322 116 53126
R 0436	RES.METAL FILM	MRS25	1%	100E	5322 116 53126
R 0447	RES.METAL FILM	MRS25	1%	100E	5322 116 53126
R 0448	RES.METAL FILM	MRS25	1%	100E	5322 116 53126
R 0449	RES.METAL FILM	MRS25	1%	215E	5322 116 53325
R 0451	RES.METAL FILM	MRS25	1%	100E	5322 116 53126
R 0452	RES.METAL FILM	MRS25	1%	10K	4822 116 53022
R 0454	RES.METAL FILM	MRS25	1%	100E	5322 116 53126
R 0456	RES.METAL FILM	MRS25	1%	100K	4822 050 21004
R 0457	RES.METAL FILM	MRS25	1%	10K	4822 116 53022
R 0458	RES.METAL FILM	MRS25	1%	422E	5322 116 53592
R 0501	RES.METAL FILM	MRS25	1%	909E	4822 116 53533
R 0502	RES.METAL FILM	MRS25	1%	909E	4822 116 53533
R 0503	RES.METAL FILM	MRS25	1%	511E	5322 116 53135
R 0504	RES.METAL FILM	MRS25	1%	511E	5322 116 53135
R 0506	RES.METAL FILM	MRS25	1%	215E	5322 116 53325
R 0507	RES.METAL FILM	MRS25	1%	1K62	5322 116 53257
R 0508	RES.METAL FILM	MRS25	1%	909E	4822 116 53533
R 0509	RES.METAL FILM	MRS25	1%	909E	4822 116 53533
R 0510	RES.METAL FILM	MRS25	1%	511E	5322 116 53135
R 0511	RES.METAL FILM	MRS25	1%	511E	5322 116 53135
R 0512	RES.METAL FILM	MRS25	1%	215E	5322 116 53325
R 0513	RES.METAL FILM	MRS25	1%	1K	4822 116 53108
R 0514	RES.METAL FILM	MRS25	1%	1K96	5322 116 53237
R 0515	RES.METAL FILM	MRS25	1%	2K37	5322 116 53503
R 0516	RES.METAL FILM	MRS25	1%	5K11	5322 116 53494
R 0517	RES.METAL FILM	MRS25	1%	10E	4822 116 52891
R 0518	RES.METAL FILM	MRS25	1%	10E	4822 116 52891
R 0519	RES.METAL FILM	MRS25	1%	10E	4822 116 52891
R 0521	RES.METAL FILM	MRS25	1%	287E	5322 116 53221
R 0522	RES.METAL FILM	MRS25	1%	1K	4822 116 53108
R 0523	RES.METAL FILM	MRS25	1%	10K	4822 116 53022
R 0524	RES.METAL FILM	MRS25	1%	1K	4822 116 53108
R 0525	RES.METAL FILM	MRS25	1%	1K	4822 116 53108
R 0526	RES.METAL FILM	MRS25	1%	10K	4822 116 53022
R 0527	RES.METAL FILM	MRS25	1%	1K	4822 116 53108
R 0528	RES.METAL FILM	MRS25	1%	287E	5322 116 53221
R 0531	RES.METAL FILM	MRS25	1%	2K15	5322 116 53239
R 0532	RES.METAL FILM	MRS25	1%	10E	4822 116 52891
R 0533	RES.METAL FILM	MRS25	1%	10E	4822 116 52891
R 0534	RES.METAL FILM	MRS25	1%	215E	5322 116 53325
R 0536	RES.METAL FILM	MRS25	1%	422E	5322 116 53592
R 0537	RES.METAL FILM	MRS25	1%	215E	5322 116 53325
R 0538	RES.METAL FILM	MRS25	1%	51E1	5322 116 53213
R 0539	RES.METAL FILM	MRS25	1%	422E	5322 116 53592
R 0541	RES.METAL FILM	MRS25	1%	10K	4822 116 53022
R 0542	POTM.SLIDE	0.3W	25%	22K	5322 105 20043
R 0543	RES.METAL FILM	MRS25	1%	348K	5322 116 80115
R 0545	RES.METAL FILM	MRS25	1%	2K87	5322 116 53513
R 0546	RES.METAL FILM	MRS25	1%	2K87	5322 116 53513
R 0548	RES.METAL FILM	MRS25	1%	10E	4822 116 52891
R 0549	RES.METAL FILM	MRS25	1%	10K	4822 116 53022
R 0550	POTM.SLIDE	0.3W	25%	4K7	5322 105 20042
R 0551	RES.METAL FILM	MRS25	1%	10K	4822 116 53022
R 0553	POTM.SLIDE	0.3W	25%	4K7	5322 105 20042
R 0554	RES.METAL FILM	MRS25	1%	100E	5322 116 53126
R 0556	RES.METAL FILM	MRS25	1%	5K11	5322 116 53494
R 0557	RES.METAL FILM	MRS25	1%	1K1	5322 116 53473
R 0558	RES.METAL FILM	MRS25	1%	3K48	4822 116 53315
R 0559	RES.METAL FILM	MRS25	1%	13K3	5322 116 53489
R 0560	RES.METAL FILM	MRS25	1%	100E	5322 116 53126
R 0561	RES.METAL FILM	MRS25	1%	10K	4822 116 53022
R 0562	RES.METAL FILM	MRS25	1%	10K	4822 116 53022
R 0563	RES.METAL FILM	MRS25	1%	3K16	4822 116 53021
R 0564	RES.METAL FILM	MRS25	1%	2K15	5322 116 53239
R 0565	RES.METAL FILM	MRS25	1%	8K25	5322 116 53267
R 0566	RES.METAL FILM	MRS25	1%	5K11	5322 116 53494
R 0568	RES.METAL FILM	MRS25	1%	4K64	5322 116 53213
R 0569	RES.METAL FILM	MRS25	1%	42E2	5322 116 53515
R 0571	RES.METAL FILM	MRS25	1%	3K83	4822 116 53079
R 0572	RES.METAL FILM	MRS25	1%	8K25	5322 116 53267
R 0573	RES.METAL FILM	MRS25	1%	3K48	4822 116 53315
R 0574	RES.METAL FILM	MRS25	1%	1K78	5322 116 53208
R 0575	RES.METAL FILM	MRS25	1%	10K	4822 116 53022
R 0576	RES.METAL FILM	MRS25	1%	5K11	5322 116 53494
R 0577	RES.METAL FILM	MRS25	1%	5K11	5322 116 53494
R 0578	RES.METAL FILM	MRS25	1%	10K	4822 116 53022
R 0579	RES.METAL FILM	MRS25	1%	10E	4822 116 52891
R 0581	RES.METAL FILM	MRS25	1%	10E	4822 116 52891
R 0582	RES.METAL FILM	MRS25	1%	1K21	4822 116 52956
R 0583	RES.METAL FILM	MRS25	1%	10E	4822 116 52891
R 0584	RES.METAL FILM	MRS25	1%	100E	5322 116 53126
R 0585	RES.METAL FILM	MRS25	1%	10K	4822 116 53022
R 0586	RES.METAL FILM	MRS25	1%	10K	4822 116 53022
R 0587	RES.METAL FILM	MRS25	1%	26K1	5322 116 53261
R 0588	RES.METAL FILM	MRS25	1%	7K5	4822 116 53028
R 0589	RES.METAL FILM	MRS25	1%	15K4	5322 116 53234
R 0591	RES.METAL FILM	MRS25	1%	46K4	5322 116 53314
R 0592	RES.METAL FILM	MRS25	1%	46K4	5322 116 53314
R 0593	RES.METAL FILM	MRS25	1%	5K11	5322 116 53494
R 0594	RES.METAL FILM	MRS25	1%	3K16	4822 116 53021
R 0595	RES.METAL FILM	MRS25	1%	10E	4822 116 52891
R 0596	RES.METAL FILM	MRS25	1%	10K	4822 116 53022
R 0598	RES.METAL FILM	MRS25	1%	51E1	5322 116 53213
R 0599	RES.METAL FILM	MRS25	1%	511E	5322 116 53135
R 0600	RES.METAL FILM	MRS25	1%	100K	4822 050 21004
R 0601	RES.METAL FILM	MRS25	1%	10K	4822 116 53022
R 0601	POTM.SLIDE	0.3W	25%	22K	5322 105 20043
R 0602	RES.METAL FILM	MRS25	1%	5K62	5322 116 53495
R 0602	RES.METAL FILM	MRS25	1%	11K	4822 116 52907
R 0603	RES.METAL FILM	MRS25	1%	10K	4822 116 53022
R 0603	RES.METAL FILM	MRS25	1%	261E	5322 116 53549
R 0604	RES.METAL FILM	MRS25	1%	10K	4822 116 53022
R 0604	RES.METAL FILM	MRS25	1%	10K	4822 116 53022
R 0605	RES.METAL FILM	MRS25	1%	100K	4822 050 21004
R 0605	RES.METAL FILM	MRS25	1%	11K	4822 116 52907
R 0606	RES.METAL FILM	MRS25	1%	16K2	5322 116 53589
R 0606	POTM.SLIDE	0.3W	25%	4K7	5322 105 20042
R 0607	RES.METAL FILM	MRS25	1%	2K15	5322 116 53239
R 0607	RES.METAL FILM	MRS25	1%	511E	5322 116 53135
R 0608	RES.METAL FILM	MRS25	1%	2K15	5322 116 53239
R 0608	RES.METAL FILM	MRS25	1%	511E	5322 116 53135
R 0609	RES.METAL FILM	MRS25	1%	2K15	5322 116 53239
R 0609	RES.METAL FILM	MRS25	1%	511E	5322 116 53135
R 0610	RES.METAL FILM	MRS25	1%	10K	4822 116 53022
R 0611	RES.METAL FILM	MRS25	1%	2K15	5322 116 53239
R 0611	RES.METAL FILM	MRS25	1%	511E	5322 116 53135
R 0612	RES.METAL FILM	MRS25	1%	422E	5322 116 53592
R 0612	RES.METAL FILM	MRS25	1%	2K15	5322 116 53239
R 0613	RES.METAL FILM	MRS25	1%	422E	5322 116 53592
R 0613	RES.METAL FILM	MRS25	1%	7K5	4822 116 53028
R 0614	RES.METAL FILM	MRS25	1%	10K	4822 116 53022
R 0614	RES.METAL FILM	MRS25	1%	10K	4822 116 53022
R 0615	RES.METAL FILM	MRS25	1%	1K47	5322 116 53185
R 0616	RES.METAL FILM	MRS25	1%	75E	5322 116 53339
R 0616	RES.METAL FILM	MRS25	1%	12K1	4822 116 52957
R 0617	RES.METAL FILM	MRS25	1%	75E	5322 116 53339
R 0618	RES.METAL FILM	MRS25	1%	10K	4822 116 53022
R 0619	RES.METAL FILM	MRS25	1%	2K15	5322 116 53239
R 0621	RES.METAL FILM	MRS25	1%	51E1	5322 116 53213
R 0621	RES.METAL FILM	MRS25	1%	5E11	4822 116 52999
R 0622	RES.METAL FILM	MRS25	1%	1K62	5322 116 53257
R 0622	RES.METAL FILM	MRS25	1%	5E11	4822 116 52999
R 0623	RES.METAL FILM	MRS25	1%	1K62	5322 116 53257
R 0624	RES.METAL FILM	MRS25	1%	178K	5322 116 53555
R 0624	RES.METAL FILM	MRS25	1%	5E11	4822 116 52999
R 0626	RES.METAL FILM	MRS25	1%	26K1	5322 116 53261
R 0627	RES.METAL FILM	MRS25	1%	178K	5322 116 53555
R 0627	RES.METAL FILM	MRS25	1%	5E11	4822 116 52999
R 0628	RES.METAL FILM	MRS25	1%	1M	4822 116 52843
R 0628	RES.METAL FILM	MRS25	1%	5E11	4822 116 52999
R 0629	RES.METAL FILM	MRS25	1%	2K15	5322 116 53239
R 0629	RES.METAL FILM	MRS25	1%	5E11	4822 116 52999
R 0631	RES.METAL FILM	MRS25	1%	12K1	4822 116 52957
R 0633	RES.METAL FILM	MRS25	1%	1M	4822 116 52843
R 0634	RES.METAL FILM	MRS25	1%	2K15	5322 116 53239
R 0636	RES.METAL FILM	MRS25	1%	51K1	4822 116 53121
R 0637	RES.METAL FILM	MRS25	1%	16K2	5322 116 53589
R 0638	RES.METAL FILM	MRS25	1%	511E	5322 116 53135
R 0639	RES.METAL FILM	MRS25	1%	511E	5322 116 53135
R 0641	RES.METAL FILM	MRS25	1%	12K1	4822 116 52957
R 0642	RES.METAL FILM	MRS25	1%	422E	5322 116 53592

POSNR	DESCRIPTION				ORDERING CODE
R 0643	RES.METAL FILM	MRS25	1%	422E	5322 116 53592
R 0644	RES.METAL FILM	MRS25	1%	16K2	5322 116 53589
R 0646	RES.METAL FILM	MRS25	1%	5K62	5322 116 53495
R 0647	RES.METAL FILM	MRS25	1%	1K78	5322 116 53208
R 0648	RES.METAL FILM	MRS25	1%	6K81	5322 116 53252
R 0649	RES.METAL FILM	MRS25	1%	51K1	4822 116 53121
R 0651	RES.METAL FILM	MRS25	1%	16K2	5322 116 53589
R 0652	RES.METAL FILM	MRS25	1%	511E	5322 116 53135
R 0653	RES.METAL FILM	MRS25	1%	511E	5322 116 53135
R 0654	RES.METAL FILM	MRS25	1%	422E	5322 116 53592
R 0656	RES.METAL FILM	MRS25	1%	422E	5322 116 53592
R 0657	RES.METAL FILM	MRS25	1%	16K2	5322 116 53589
R 0658	RES.METAL FILM	MRS25	1%	51K1	4822 116 53121
R 0659	RES.METAL FILM	MRS25	1%	5K62	5322 116 53495
R 0661	RES.METAL FILM	MRS25	1%	1K78	5322 116 53208
R 0662	RES.METAL FILM	MRS25	1%	6K81	5322 116 53252
R 0663	RES.METAL FILM	MRS25	1%	51K1	4822 116 53121
R 0666	RES.METAL FILM	MRS25	1%	51E1	5322 116 53213
R 0669	RES.METAL FILM	MRS25	1%	1K62	5322 116 53257
R 0671	RES.METAL FILM	MRS25	1%	1K62	5322 116 53257
R 0681	RES.METAL FILM	MRS25	1%	5E11	4822 116 52999
R 0682	RES.METAL FILM	MRS25	1%	5E11	4822 116 52999
R 0701	RES.CHIP	MCR18	1%	4K7	5322 111 90111
R 0702	RES.CHIP	MCR18	1%	47E	4822 111 90217
R 0703	RES.NETWORK	MCR18	1%	100E	5322 111 91134
R 0704	RES.CHIP	RC-02H	1%	10K	5322 116 80428
R 0706	RES.CHIP	MCR18	1%	180E	5322 111 90242
R 0707	RES.CHIP	MCR18	1%	47E	4822 111 90217
R 0708	RES.CHIP	MCR18	1%	4K7	5322 111 90111
R 0709	RES.CHIP	MCR18	1%	330E	5322 111 90106
R 0711	RES.CHIP	MCR18	1%	470E	5322 111 90109
R 0712	RES.CHIP	MCR18	1%	3K3	4822 111 90157
R 0713	RES.CHIP	MCR18	1%	470E	5322 111 90109
R 0714	RES.CHIP	MCR18	1%	330E	5322 111 90106
R 0715	RES.NETWORK	MCR18	1%	100E	5322 111 91134
R 0716	RES.CHIP	RC-02H	1%	750E	4822 116 82384
R 0717	RES.CHIP	RC-02H	1%	10K	5322 116 80428
R 0718	RES.CHIP	RC-02H	1%	10K	5322 116 80428
R 0719	RES.CHIP	RC-02H	1%	750E	4822 116 82384
R 0720	RES.CHIP	MCR18	1%	220E	4822 111 90178
R 0721	RES.CHIP	RC-02H	1%	10K	5322 116 80428
R 0722	RES.NETWORK	MCR18	1%	3K9	5322 111 91135
R 0723	RES.CHIP	MCR18	1%	15K	4822 111 90196
R 0724	RES.CHIP	RC-02H	1%	10K	5322 116 80428
R 0725	RES.CHIP	MCR18	1%	1K	4822 051 10102
R 0726	RES.NETWORK	MCR18	1%	22K	5322 111 91349
R 0727	RES.CHIP	MCR18	1%	27K	4822 111 90542
R 0728	RES.CHIP	RC-02H	1%	10K	5322 116 80428
R 0729	RES.CHIP	MCR18	1%	12K	4822 111 90253
R 0731	RES.CHIP	MCR18	1%	6K8	4822 111 90544
R 0732	RES.CHIP	MCR18	1%	27K	4822 111 90542
R 0733	RES.NETWORK	MCR18	1%	100E	5322 111 91134
R 0734	RES.CHIP	MCR18	1%	1K2	5322 111 90096
R 0735	RES.NETWORK	MCR18	1%	100E	5322 111 91134
R 0736	RES.CHIP	MCR18	1%	1K	4822 051 10102
R 0737	RES.NETWORK	MCR18	1%	3K9	5322 111 91135
R 0738	RES.CHIP	MCR18	1%	15K	4822 111 90196
R 0739	RES.CHIP	MCR18	1%	27K	4822 111 90542
R 0741	RES.CHIP	MCR18	1%	3K3	4822 111 90157
R 0742	RES.CHIP	MCR18	1%	15K	4822 111 90196
R 0743	RES.CHIP	MCR18	1%	1K	4822 051 10102
R 0744	RES.NETWORK	MCR18	1%	3K9	5322 111 91135
R 0746	RES.CHIP	RC-02H	1%	10K	5322 116 80428
R 0747	RES.CHIP	MCR18	1%	330E	5322 111 90106
R 0748	RES.CHIP	MCR18	1%	270E	4822 111 90154
R 0749	RES.NETWORK	MCR18	1%	51E	5322 111 91352
R 0751	RES.CHIP	RC-02H	1%	10K	5322 116 80428
R 0752	RES.CHIP	MCR18	1%	68K	4822 111 90202
R 0753	RES.CHIP	MCR18	1%	4K7	5322 111 90111
R 0754	RES.CHIP	RC-02H	1%	10K	5322 116 80428
R 0755	RES.CHIP	MCR18	1%	3K3	4822 111 90157
R 0756	RES.CHIP	RC-02H	1%	10K	5322 116 80428
R 0760	RES.CHIP	MCR18	1%	1K	4822 051 10102
R 0761	RES.CHIP	MCR18	1%	6K8	4822 111 90544
R 0762	RES.CHIP	MCR18	1%	27K	4822 111 90542
R 0763	RES.NETWORK	MCR18	1%	100E	5322 111 91134
R 0764	RES.CHIP	MCR18	1%	1K2	5322 111 90096
R 0765	RES.CHIP	MCR18	1%	1K	4822 051 10102
R 0766	RES.NETWORK	MCR18	1%	100E	5322 111 91134
R 0767	RES.NETWORK	MCR18	1%	3K9	5322 111 91135
R 0768	RES.CHIP	MCR18	1%	15K	4822 111 90196
R 0769	RES.CHIP	MCR18	1%	27K	4822 111 90542
R 0770	RES.CHIP	MCR18	1%	1K	4822 051 10102
R 0771	RES.CHIP	MCR18	1%	3K3	4822 111 90157
R 0772	RES.CHIP	MCR18	1%	15K	4822 111 90196
R 0773	RES.CHIP	MCR18	1%	1K	4822 051 10102
R 0774	RES.NETWORK	MCR18	1%	3K9	5322 111 91135
R 0776	RES.CHIP	RC-02H	1%	10K	5322 116 80428
R 0777	RES.CHIP	MCR18	1%	330E	5322 111 90106
R 0778	RES.CHIP	MCR18	1%	270E	4822 111 90154
R 0779	RES.NETWORK	MCR18	1%	51E	5322 111 91352
R 0781	RES.CHIP	RC-02H	1%	10K	5322 116 80428
R 0782	RES.CHIP	MCR18	1%	68K	4822 111 90202
R 0783	RES.CHIP	MCR18	1%	4K7	5322 111 90111
R 0784	RES.CHIP	RC-02H	1%	10K	5322 116 80428
R 0785	RES.CHIP	MCR18	1%	3K3	4822 111 90157
R 0786	RES.CHIP	RC-02H	1%	10K	5322 116 80428
R 0791	RES.CHIP	MCR18	1%	10E	4822 051 10109
R 0792	RES.CHIP	MCR18	1%	10E	4822 051 10109
R 0793	RES.CHIP	MCR18	1%	10E	4822 051 10109
R 0794	RES.CHIP	MCR18	1%	10E	4822 051 10109
R 0801	RES.METAL FILM	MRS25	1%	10E	4822 116 52891
R 0802	RES.METAL FILM	MRS25	1%	100E	5322 116 53126
R 0804	RES.METAL FILM	MRS25	1%	422E	5322 116 53592
R 0805	RES.METAL FILM	MRS25	1%	316E	5322 116 53499
R 0806	RES.METAL FILM	MRS25	1%	10E	4822 116 52891
R 0807	RES.METAL FILM	MRS25	1%	100E	5322 116 53126
R 0809	RES.METAL FILM	MRS25	1%	422E	5322 116 53592
R 0810	RES.METAL FILM	MRS25	1%	316E	5322 116 53499
R 0811	RES.METAL FILM	MRS25	1%	316E	5322 116 53499
R 0812	RES.METAL FILM	MRS25	1%	1K	4822 116 53108
R 0813	RES.METAL FILM	MRS25	1%	2K61	5322 116 53327

POSNR	DESCRIPTION				ORDERING CODE	
R 0814	RES.METAL FILM	MRS25	1%	100E	5322 116 53126	
R 0815	RES.METAL FILM	MRS25	1%	316E	5322 116 53499	
R 0816	RES.METAL FILM	MRS25	1%	10E	4822 116 52891	
R 0817	RES.METAL FILM	MRS25	1%	100E	5322 116 53126	
R 0818	RES.METAL FILM	MRS25	1%	10E	4822 116 52891	
R 0819	RES.METAL FILM	MRS25	1%	162E	5322 116 53523	
R 0821	RES.METAL FILM	MRS25	1%	162E	5322 116 53523	
R 0822	RES.METAL FILM	MRS25	1%	10E	4822 116 52891	
R 0823	RES.METAL FILM	MRS25	1%	100E	5322 116 53126	
R 0824	RES.METAL FILM	MRS25	1%	10E	4822 116 52891	
R 0825	RES.METAL FILM	MRS25	1%	162E	5322 116 53523	
R 0826	RES.METAL FILM	MRS25	1%	162E	5322 116 53523	
R 0827	RES.METAL FILM	MRS25	1%	100E	5322 116 53126	
R 0828	RES.METAL FILM	MRS25	1%	215E	5322 116 53325	
R 0829	RES.METAL FILM	MRS25	1%	215E	5322 116 53325	
R 0831	RES.METAL FILM	MRS25	1%	10E	4822 116 52891	
R 0832	RES.METAL FILM	MRS25	1%	100E	5322 116 53126	
R 0834	RES.METAL FILM	MRS25	1%	422E	5322 116 53592	
R 0835	RES.METAL FILM	MRS25	1%	316E	5322 116 53499	
R 0836	RES.METAL FILM	MRS25	1%	10E	4822 116 52891	
R 0837	RES.METAL FILM	MRS25	1%	100E	5322 116 53126	
R 0839	RES.METAL FILM	MRS25	1%	422E	5322 116 53592	
R 0840	RES.METAL FILM	MRS25	1%	316E	5322 116 53499	
R 0841	RES.METAL FILM	MRS25	1%	316E	5322 116 53499	
R 0842	RES.METAL FILM	MRS25	1%	1K	4822 116 53108	
R 0843	RES.METAL FILM	MRS25	1%	2K61	5322 116 53327	
R 0844	RES.METAL FILM	MRS25	1%	100E	5322 116 53126	
R 0845	RES.METAL FILM	MRS25	1%	316E	5322 116 53499	
R 0846	RES.METAL FILM	MRS25	1%	10E	4822 116 52891	
R 0847	RES.METAL FILM	MRS25	1%	100E	5322 116 53126	
R 0848	RES.METAL FILM	MRS25	1%	10E	4822 116 52891	
R 0849	RES.METAL FILM	MRS25	1%	162E	5322 116 53523	
R 0851	RES.METAL FILM	MRS25	1%	162E	5322 116 53523	
R 0852	RES.METAL FILM	MRS25	1%	10E	4822 116 52891	
R 0853	RES.METAL FILM	MRS25	1%	100E	5322 116 53126	
R 0854	RES.METAL FILM	MRS25	1%	10E	4822 116 52891	
R 0855	RES.METAL FILM	MRS25	1%	162E	5322 116 53523	
R 0856	RES.METAL FILM	MRS25	1%	162E	5322 116 53523	
R 0857	RES.METAL FILM	MRS25	1%	100E	5322 116 53126	
R 0858	RES.METAL FILM	MRS25	1%	215E	5322 116 53325	
R 0859	RES.METAL FILM	MRS25	1%	215E	5322 116 53325	
R 0860	RES.METAL FILM	MRS25	1%	1E	4822 050 21008	
R 0861	RES.METAL FILM	MRS25	1%	5E11	4822 116 52999	
R 0862	RES.METAL FILM	MRS25	1%	2K15	5322 116 53239	*
R 0863	RES.METAL FILM	MRS25	1%	1K	4822 116 53108	
R 0864	RES.METAL FILM	MRS25	1%	422E	5322 116 53592	
R 0865	RES.METAL FILM	MRS25	1%	1K	4822 116 53108	
R 0866	RES.METAL FILM	MRS25	1%	51E1	5322 116 53213	
R 0867	RES.METAL FILM	MRS25	1%	51E1	5322 116 53213	
R 0868	RES.METAL FILM	MRS25	1%	237E	5322 116 53259	
R 0869	RES.METAL FILM	MRS25	1%	51E1	5322 116 53213	
R 0870	RES.METAL FILM	MRS25	1%	1E	4822 050 21008	
R 0871	RES.METAL FILM	MRS25	1%	681E	4822 116 53123	
R 0872	RES.METAL FILM	MRS25	1%	5E11	4822 116 52999	
R 0873	RES.METAL FILM	MRS25	1%	2K15	5322 116 53239	
R 0874	RES.METAL FILM	MRS25	1%	1K	4822 116 53108	
R 0875	RES.METAL FILM	MRS25	1%	1K	4822 116 53108	
R 0876	RES.METAL FILM	MRS25	1%	2K15	5322 116 53239	
R 0877	RES.METAL FILM	MRS25	1%	2K15	5322 116 53239	
R 0878	RES.METAL FILM	MRS25	1%	2K15	5322 116 53239	
R 0879	RES.METAL FILM	MRS25	1%	2K15	5322 116 53239	
R 0880	RES.METAL FILM	MRS25	1%	1E	4822 050 21008	
R 0882	RES.METAL FILM	MRS25	1%	100E	5322 116 53126	*
R 0883	RES.METAL FILM	MRS25	1%	100E	5322 116 53126	*
R 0884	RES.METAL FILM	MRS25	1%	100E	5322 116 53126	*
R 0885	RES.METAL FILM	MRS25	1%	1K	4822 116 53108	
R 0886	RES.METAL FILM	MRS25	1%	100E	5322 116 53126	*
R 0887	RES.METAL FILM	MRS25	1%	2K61	5322 116 53327	
R 0888	RES.METAL FILM	MRS25	1%	10K	4822 116 53022	
R 0889	RES.METAL FILM	MRS25	1%	121E	4822 116 52955	
R 0890	RES.METAL FILM	MRS25	1%	316E	5322 116 53499	
R 0891	RES.METAL FILM	MRS25	1%	5K11	5322 116 53494	
R 0892	POTM.TRIMMER	0.3W	25%	10K	4822 105 10455	
R 0893	RES.METAL FILM	MRS25	1%	5K11	5322 116 53494	
R 0894	POTM.TRIMMER	0.3W	25%	10K	4822 105 10455	
R 0895	RES.METAL FILM	MRS25	1%	17K8	5322 116 53235	
R 0896	RES.METAL FILM	MRS25	1%	121K	4822 050 21214	
R 0901	RES.METAL FILM	MRS25	1%	3K16	4822 116 53021	
R 0902	POTM.SLIDE	0.3W	25%	2K2	5322 105 20033	
R 0904	RES.METAL FILM	MRS25	1%	4K22	5322 116 53246	
R 0905	RES.METAL FILM	MRS25	1%	4K22	5322 116 53246	
R 0906	RES.METAL FILM	MRS25	1%	4K22	5322 116 53246	
R 0909	RES.METAL FILM	MRS25	1%	4K22	5322 116 53246	
R 0911	RES.METAL FILM	MRS25	1%	4K22	5322 116 53246	
R 0914	RES.METAL FILM	MRS25	1%	4K22	5322 116 53246	
R 0915	RES.METAL FILM	MRS25	1%	4K22	5322 116 53246	
R 0916	RES.METAL FILM	MRS25	1%	3K16	4822 116 53021	
R 0917	POTM.SLIDE	0.3W	25%	2K2	5322 105 20033	
R 0919	RES.METAL FILM	MRS25	1%	4K22	5322 116 53246	
R 0921	RES.METAL FILM	MRS25	1%	4K22	5322 116 53246	
R 0922	RES.METAL FILM	MRS25	1%	4K22	5322 116 53246	
R 0924	RES.METAL FILM	MRS25	1%	5K11	5322 116 53494	
R 0925	RES.METAL FILM	MRS25	1%	5K11	5322 116 53494	
R 0926	RES.METAL FILM	MRS25	1%	2K87	5322 116 53513	
R 0927	RES.METAL FILM	MRS25	1%	100E	5322 116 53126	*
R 0929	POTM.TRIMMER	0.3W	25%	10K	4822 105 10455	
R 0931	RES.METAL FILM	MRS25	1%	1K47	5322 116 53185	
R 0932	POTM.SLIDE	0.3W	25%	4K7	5322 105 20034	
R 0933	RES.METAL FILM	MRS25	1%	17K8	5322 116 53235	
R 0934	RES.METAL FILM	MRS25	1%	5K11	5322 116 53494	
R 0935	RES.METAL FILM	MRS25	1%	5K11	5322 116 53494	
R 0936	RES.METAL FILM	MRS25	1%	5K11	5322 116 53494	
R 0937	RES.METAL FILM	MRS25	1%	100E	5322 116 53126	*
R 0939	POTM.TRIMMER	0.3W	25%	10K	4822 105 10455	
R 0941	RES.METAL FILM	MRS25	1%	1K47	5322 116 53185	
R 0942	POTM.SLIDE	0.3W	25%	4K7	5322 105 20034	
R 0944	RES.METAL FILM	MRS25	1%	5K11	5322 116 53494	
R 0945	RES.METAL FILM	MRS25	1%	5K11	5322 116 53494	
R 0946	RES.METAL FILM	MRS25	1%	2K87	5322 116 53513	
R 0947	RES.METAL FILM	MRS25	1%	100E	5322 116 53126	*
R 0953	RES.METAL FILM	MRS25	1%	17K8	5322 116 53235	
R 0954	RES.METAL FILM	MRS25	1%	5K11	5322 116 53494	
R 0955	RES.METAL FILM	MRS25	1%	5K11	5322 116 53494	

*: FOR PM3350A ONLY; FOR PM3355 SEE PAGE 25-27

POSNR	DESCRIPTION				ORDERING CODE	
R 0956	RES.METAL FILM	MRS25	1%	5K11	5322 116 53494	
R 0957	RES.METAL FILM	MRS25	1%	100E	5322 116 53126	*
R 0958	RES.METAL FILM	MRS25	1%	4K64	5322 116 53213	
R 0961	RES.METAL FILM	MRS25	1%	121E	4822 116 52955	
R 0962	RES.METAL FILM	MRS25	1%	75E	5322 116 53339	
R 0965	RES.METAL FILM	MRS25	1%	10K	4822 116 53022	
R 0966	POTM.TRIMMER	0.3W	25%	10K	4822 105 10455	
R 0967	RES.METAL FILM	MRS25	1%	10K	4822 116 53022	
R 0968	RES.METAL FILM	MRS25	1%	100E	5322 116 53126	
R 0969	RES.METAL FILM	MRS25	1%	10K	4822 116 53022	
R 0970	POTM.TRIMMER	0.3W	25%	10K	4822 105 10455	
R 0971	RES.METAL FILM	MRS25	1%	10K	4822 116 53022	
R 0972	RES.METAL FILM	MRS25	1%	100E	5322 116 53126	
R 0973	RES.METAL FILM	MRS25	1%	10K	4822 116 53022	
R 0974	POTM.TRIMMER	0.3W	25%	10K	4822 105 10455	
R 0975	RES.METAL FILM	MRS25	1%	10K	4822 116 53022	
R 0976	RES.METAL FILM	MRS25	1%	10K	4822 116 53022	
R 0977	POTM.TRIMMER	0.3W	25%	10K	4822 105 10455	
R 0978	RES.METAL FILM	MRS25	1%	10K	4822 116 53022	
R 0979	RES.METAL FILM	MRS25	1%	5K11	5322 116 53494	
R 0981	RES.METAL FILM	MRS25	1%	17K8	5322 116 53235	
R 0983	RES.METAL FILM	MRS25	1%	5E11	4822 116 52999	
R 0984	RES.METAL FILM	MRS25	1%	5E11	4822 116 52999	
R 0985	RES.METAL FILM	MRS25	1%	5E11	4822 116 52999	
R 0986	RES.METAL FILM	MRS25	1%	5E11	4822 116 52999	
R 0987	RES.METAL FILM	MRS25	1%	10K	4822 116 53022	
R 0988	RES.METAL FILM	MRS25	1%	14K7	4822 116 53531	
R 0989	RES.METAL FILM	MRS25	1%	10K	4822 116 53022	
R 0991	RES.METAL FILM	MRS25	1%	14K7	4822 116 53531	
R 0992	RES.METAL FILM	MRS25	1%	1K	4822 116 53108	
R 0993	RES.METAL FILM	MRS25	1%	1K	4822 116 53108	
R 0996	RES.METAL FILM	MRS25	1%	1E	4822 050 21008	
R 0997	RES.METAL FILM	MRS25	1%	1K33	5322 116 53512	
R 0998	RES.METAL FILM	MRS25	1%	6K81	5322 116 53252	
R 1004	RES.METAL FILM	1/4W	.25%	10K1	5322 116 53404	
R 1006	RES.METAL FILM	MRS25	1%	121E	4822 116 52955	
R 1007	RES.METAL FILM	0.4W	0.25%	900K	5322 116 53414	
R 1008	RES.METAL FILM	MRS25	1%	10K	4822 116 53022	
R 1009	RES.METAL FILM	MRS25	1%	21K5	5322 116 53241	
R 1011	RES.METAL FILM	1/4W	.25%	111K	5322 116 53409	
R 1012	RES.METAL FILM	0.4W	0.25%	750K	5322 116 53588	
R 1013	RES.METAL FILM	1/4W	.25%	1M	5322 116 53398	
R 1014	RES.METAL FILM	MRS25	1%	10K	4822 116 53022	
R 1016	RES.METAL FILM	MRS25	1%	21K5	5322 116 53241	
R 1017	RES.METAL FILM	1/4W	.25%	250K	5322 116 53587	
R 1018	RES.METAL FILM	MRS25	1%	10E	4822 116 52891	
R 1019	RES.METAL FILM	0.4W	0.25%	990K	5322 116 53415	
R 1022	RES.METAL FILM	MRS25	1%	56E2	5322 116 53644	
R 1023	RES.METAL FILM	VR25	10%		5322 116 51785	
R 1024	RES.METAL FILM	MRS25	1%	10E	4822 116 52891	
R 1026	RES.METAL FILM	MRS25	1%	61E9	5322 116 53645	
R 1027	RES.METAL FILM	VR25	10%		5322 116 51785	
R 1028	RES.METAL FILM	MRS25	1%	10E	4822 116 52891	
R 1029	RES.METAL FILM	1/4W	.25%	1M	5322 116 53398	
R 1031	RES.METAL FILM	VR25	10%		5322 116 51785	
R 1032	RES.METAL FILM	MRS25	1%	10E	4822 116 52891	
R 1033	RES.METAL FILM	VR25	10%		5322 116 51785	
R 1034	RES.METAL FILM	MRS25	1%	1M	4822 116 52843	
R 1035	RES.METAL FILM	MRS25	1%	100E	5322 116 53126	
R 1036	POTM.SLIDE	0.3W	25%	22K	5322 105 20035	
R 1037	RES.METAL FILM	MRS25	1%	100K	4822 050 21004	
R 1038	RES.METAL FILM	VR25	10%		5322 116 51785	
R 1039	RES.METAL FILM	MRS25	1%	1K96	5322 116 53237	
R 1040	RES.METAL FILM	MRS25	1%	287E	5322 116 53221	
R 1041	RES.METAL FILM	MRS25	1%	1K96	5322 116 53237	
R 1043	RES.METAL FILM	MRS25	1%	100E	5322 116 53126	
R 1044	RES.METAL FILM	MRS25	1%	825E	5322 116 53541	
R 1045	RES.METAL FILM	MRS25	1%	100E	5322 116 53126	
R 1046	RES.METAL FILM	MRS25	1%	511E	5322 116 53135	
R 1047	RES.METAL FILM	MRS25	1%	2K15	5322 116 53239	
R 1048	RES.METAL FILM	MRS25	1%	5K11	5322 116 53494	
R 1049	RES.METAL FILM	MRS25	1%	1K47	5322 116 53185	
R 1050	RES.METAL FILM	MRS25	1%	100E	5322 116 53126	
R 1051	RES.METAL FILM	MRS25	1%	681E	4822 116 53123	
R 1052	RES.METAL FILM	MRS25	1%	1K78	5322 116 53208	
R 1053	RES.METAL FILM	1/4W	.25%	250E	5322 116 53406	
R 1054	RES.METAL FILM	MRS25	1%	100E	5322 116 53126	
R 1055	RES.METAL FILM	MRS25	1%	1K78	5322 116 53208	
R 1056	RES.METAL FILM	1/4W	.25%	375E	5322 116 53407	
R 1057	RES.METAL FILM	1/4W	.25%	150E	5322 116 53399	
R 1058	RES.METAL FILM	1/4W	.25%	150E	5322 116 53399	
R 1061	RES.METAL FILM	MRS25	1%	110E	4822 116 52906	
R 1062	RES.METAL FILM	MRS25	1%	10E	4822 116 52891	
R 1063	RES.METAL FILM	MRS25	1%	26K1	5322 116 53261	
R 1064	POTM.TRIMMER	0.3W	25%	10K	4822 105 10455	
R 1066	RES.METAL FILM	MRS25	1%	21K5	5322 116 53241	
R 1067	RES.METAL FILM	MRS25	1%	31K6	5322 116 53262	
R 1068	RES.METAL FILM	MRS25	1%	162E	5322 116 53523	
R 1069	POTM.SLIDE	0.3W	25%	100E	5322 105 20029	
R 1071	RES.METAL FILM	MRS25	1%	26K1	5322 116 53261	
R 1072	POTM.TRIMMER	0.3W	25%	10K	4822 105 10455	
R 1073	RES.METAL FILM	MRS25	1%	6K81	5322 116 53252	
R 1074	RES.METAL FILM	MRS25	1%	12K1	4822 116 52957	
R 1076	POTM.SLIDE	0.3W	25%	100E	5322 105 20029	
R 1077	RES.METAL FILM	MRS25	1%	51E1	5322 116 53213	
R 1078	RES.METAL FILM	MRS25	1%	14K7	4822 116 53531	
R 1079	RES.METAL FILM	MRS25	1%	1K62	5322 116 53257	
R 1081	RES.METAL FILM	MRS25	1%	511E	5322 116 53135	
R 1082	RES.METAL FILM	MRS25	1%	90K9	5322 116 53582	
R 1083	RES.METAL FILM	MRS25	1%	10K	4822 116 53022	
R 1084	RES.METAL FILM	MRS25	1%	100K	4822 050 21004	
R 1086	RES.METAL FILM	MRS25	1%	10K	4822 116 53022	
R 1088	RES.METAL FILM	MRS25	1%	100E	5322 116 53126	
R 1089	RES.METAL FILM	MRS25	1%	422E	5322 116 53592	
R 1091	POTM.SLIDE	0.3W	25%	100E	5322 105 20029	
R 1092	RES.METAL FILM	MRS25	1%	10E	4822 116 52891	
R 1093	RES.METAL FILM	MRS25	1%	422E	5322 116 53592	
R 1094	RES.METAL FILM	MRS25	1%	100E	5322 116 53126	
R 1096	RES.METAL FILM	MRS25	1%	100E	5322 116 53126	
R 1097	RES.METAL FILM	MRS25	1%	100E	5322 116 53126	
R 1098	RES.METAL FILM	MRS25	1%	1K21.	4822 116 52956	

POSNR	DESCRIPTION				ORDERING CODE
R 1099	RES.METAL FILM	MRS25	1%	1K21	4822 116 52956
R 1101	RES.METAL FILM	MRS25	1%	1K	4822 116 53108
R 1102	RES.METAL FILM	MRS25	1%	42E2	5322 116 53515
R 1103	RES.METAL FILM	MRS25	1%	61E9	5322 116 53645
R 1104	RES.METAL FILM	1/4W	.25%	10K1	5322 116 53404
R 1106	RES.METAL FILM	MRS25	1%	121E	4822 116 52955
R 1107	RES.METAL FILM	0.4W	0.25%	900K	5322 116 53414
R 1108	RES.METAL FILM	MRS25	1%	10K	4822 116 53022
R 1109	RES.METAL FILM	MRS25	1%	21K5	5322 116 53241
R 1111	RES.METAL FILM	1/4W	.25%	111K	5322 116 53409
R 1112	RES.METAL FILM	0.4W	0.25%	750K	5322 116 53588
R 1113	RES.METAL FILM	1/4W	.25%	1M	5322 116 53398
R 1114	RES.METAL FILM	MRS25	1%	10K	4822 116 53022
R 1116	RES.METAL FILM	MRS25	1%	21K5	5322 116 53241
R 1117	RES.METAL FILM	1/4W	.25%	250K	5322 116 53587
R 1118	RES.METAL FILM	MRS25	1%	10E	4822 116 52891
R 1119	RES.METAL FILM	0.4W	0.25%	990K	5322 116 53415
R 1122	RES.METAL FILM	MRS25	1%	56E2	5322 116 53644
R 1123	RES.METAL FILM	VR25	10%		5322 116 51785
R 1124	RES.METAL FILM	MRS25	1%	10E	4822 116 52891
R 1126	RES.METAL FILM	MRS25	1%	61E9	5322 116 53645
R 1127	RES.METAL FILM	VR25	10%		5322 116 51785
R 1128	RES.METAL FILM	MRS25	1%	10E	4822 116 52891
R 1129	RES.METAL FILM	1/4W	.25%	1M	5322 116 53398
R 1131	RES.METAL FILM	VR25	10%		5322 116 51785
R 1132	RES.METAL FILM	MRS25	1%	10E	4822 116 52891
R 1133	RES.METAL FILM	VR25	10%		5322 116 51785
R 1134	RES.METAL FILM	MRS25	1%	1M	4822 116 52843
R 1135	RES.METAL FILM	MRS25	1%	100E	5322 116 53126
R 1136	POTM.SLIDE	0.3W	25%	22K	5322 105 20035
R 1137	RES.METAL FILM	MRS25	1%	100K	4822 050 21004
R 1138	RES.METAL FILM	VR25	10%		5322 116 51785
R 1139	RES.METAL FILM	MRS25	1%	1K96	5322 116 53237
R 1140	RES.METAL FILM	MRS25	1%	287E	5322 116 53221
R 1141	RES.METAL FILM	MRS25	1%	1K96	5322 116 53237
R 1143	RES.METAL FILM	MRS25	1%	100E	5322 116 53126
R 1144	RES.METAL FILM	MRS25	1%	825E	5322 116 53541
R 1145	RES.METAL FILM	MRS25	1%	100E	5322 116 53126
R 1146	RES.METAL FILM	MRS25	1%	511E	5322 116 53135
R 1147	RES.METAL FILM	MRS25	1%	2K15	5322 116 53239
R 1148	RES.METAL FILM	MRS25	1%	5K11	5322 116 53494
R 1149	RES.METAL FILM	MRS25	1%	1K47	5322 116 53185
R 1150	RES.METAL FILM	MRS25	1%	100E	5322 116 53126
R 1151	RES.METAL FILM	MRS25	1%	681E	4822 116 53123
R 1152	RES.METAL FILM	MRS25	1%	1K78	5322 116 53208
R 1153	RES.METAL FILM	1/4W	.25%	250E	5322 116 53406
R 1154	RES.METAL FILM	MRS25	1%	100E	5322 116 53126
R 1155	RES.METAL FILM	MRS25	1%	1K78	5322 116 53208
R 1156	RES.METAL FILM	1/4W	.25%	375E	5322 116 53407
R 1157	RES.METAL FILM	1/4W	.25%	150E	5322 116 53399
R 1158	RES.METAL FILM	1/4W	.25%	150E	5322 116 53399
R 1161	RES.METAL FILM	MRS25	1%	110E	4822 116 52906
R 1162	RES.METAL FILM	MRS25	1%	10E	4822 116 52891
R 1163	RES.METAL FILM	MRS25	1%	26K1	5322 116 53261
R 1164	POTM.TRIMMER	0.3W	25%	10K	4822 105 10455
R 1166	RES.METAL FILM	MRS25	1%	21K5	5322 116 53241
R 1167	RES.METAL FILM	MRS25	1%	31K6	5322 116 53262
R 1168	RES.METAL FILM	MRS25	1%	162E	5322 116 53523
R 1169	POTM.SLIDE	0.3W	25%	100E	5322 105 20029
R 1171	RES.METAL FILM	MRS25	1%	26K1	5322 116 53261
R 1172	POTM.TRIMMER	0.3W	25%	10K	4822 105 10455
R 1173	RES.METAL FILM	MRS25	1%	6K81	5322 116 53252
R 1174	RES.METAL FILM	MRS25	1%	12K1	4822 116 52957
R 1176	POTM.SLIDE	0.3W	25%	100E	5322 105 20029
R 1177	RES.METAL FILM	MRS25	1%	51E1	5322 116 53213
R 1178	RES.METAL FILM	MRS25	1%	14K7	4822 116 53531
R 1179	RES.METAL FILM	MRS25	1%	1K62	5322 116 53257
R 1181	RES.METAL FILM	MRS25	1%	511E	5322 116 53135
R 1182	RES.METAL FILM	MRS25	1%	90K9	5322 116 53582
R 1183	RES.METAL FILM	MRS25	1%	10K	4822 116 53022
R 1184	RES.METAL FILM	MRS25	1%	100K	4822 050 21004
R 1186	RES.METAL FILM	MRS25	1%	10K	4822 116 53022
R 1188	RES.METAL FILM	MRS25	1%	100E	5322 116 53126
R 1189	RES.METAL FILM	MRS25	1%	422E	5322 116 53592
R 1191	POTM.SLIDE	0.3W	25%	100E	5322 105 20029
R 1192	RES.METAL FILM	MRS25	1%	10E	4822 116 52891
R 1193	RES.METAL FILM	MRS25	1%	422E	5322 116 53592
R 1194	RES.METAL FILM	MRS25	1%	100E	5322 116 53126
R 1196	RES.METAL FILM	MRS25	1%	100E	5322 116 53126
R 1197	RES.METAL FILM	MRS25	1%	100E	5322 116 53126
R 1198	RES.METAL FILM	MRS25	1%	1K21	4822 116 52956
R 1199	RES.METAL FILM	MRS25	1%	1K21	4822 116 52956
R 1201	RES.METAL FILM	MRS25	1%	1K	4822 116 53108
R 1202	RES.METAL FILM	MRS25	1%	68E1	5322 116 53264
R 1203	RES.METAL FILM	0.4W	0.1%	1M	5322 116 51605
R 1204	RES.METAL FILM	VR25	10%		5322 116 51785
R 1206	RES.METAL FILM	MRS25	1%	1K96	5322 116 53237
R 1207	RES.METAL FILM	MRS25	1%	100E	5322 116 53126
R 1208	RES.METAL FILM	MRS25	1%	825E	5322 116 53541
R 1209	RES.METAL FILM	MRS25	1%	1M	4822 116 52843
R 1211	RES.METAL FILM	MRS25	1%	100E	5322 116 53126
R 1213	RES.METAL FILM	MRS25	1%	1M	4822 116 52843
R 1217	POTM.SLIDE	0.3W	25%	22K	5322 105 20035
R 1218	RES.METAL FILM	MRS25	1%	100K	4822 050 21004
R 1219	RES.METAL FILM	MRS25	1%	1K47	5322 116 53185
R 1221	RES.METAL FILM	MRS25	1%	681E	4822 116 53123
R 1222	RES.METAL FILM	MRS25	1%	2K87	5322 116 53513
R 1223	RES.METAL FILM	MRS25	1%	1K33	5322 116 53512
R 1224	RES.METAL FILM	MRS25	1%	1K	4822 116 53108
R 1226	RES.METAL FILM	MRS25	1%	5K11	5322 116 53494
R 1227	RES.METAL FILM	MRS25	1%	1K33	5322 116 53512
R 1228	RES.METAL FILM	MRS25	1%	100E	5322 116 53126
R 1229	RES.METAL FILM	MRS25	1%	750E	5322 116 53265
R 1231	RES.METAL FILM	MRS25	1%	750E	5322 116 53265
R 1232	RES.METAL FILM	MRS25	1%	82E5	5322 116 53538
R 1233	RES.METAL FILM	MRS25	1%	348E	5322 116 53591
R 1234	RES.METAL FILM	MRS25	1%	100E	5322 116 53126
R 1236	RES.METAL FILM	MRS25	1%	162E	5322 116 53523
R 1237	RES.METAL FILM	MRS25	1%	2K61	5322 116 53327
R 1238	RES.METAL FILM	MRS25	1%	100E	5322 116 53126
R 1239	RES.METAL FILM	MRS25	1%	7K5	4822 116 53028

POSNR	DESCRIPTION				ORDERING CODE
R 1401	RES.METAL FILM	MRS25	1%	5E11	4822 116 52999
R 1402	RES.METAL FILM	MRS25	1%	5E11	4822 116 52999
R 1403	RES.METAL FILM	MRS25	1%	5E11	4822 116 52999
R 1404	RES.METAL FILM	MRS25	1%	5E11	4822 116 52999
R 1421	RES.METAL FILM	MRS25	1%	5E11	4822 116 52999
R 1422	RES.METAL FILM	MRS25	1%	5E11	4822 116 52999
R 1423	RES.METAL FILM	MRS25	1%	5E11	4822 116 52999
R 1424	RES.METAL FILM	MRS25	1%	5E11	4822 116 52999
R 1441	RES.METAL FILM	MRS25	1%	100E	5322 116 53126
R 1442	RES.METAL FILM	MRS25	1%	5E11	4822 116 52999
R 1443	RES.METAL FILM	MRS25	1%	5E11	4822 116 52999
R 2001	RES.METAL FILM	MRS25	1%	10E	4822 116 52891
R 2002	RES.METAL FILM	MRS25	1%	10E	4822 116 52891
R 2003	RES.METAL FILM	MRS25	1%	51E1	5322 116 53213
R 2004	RES.METAL FILM	MRS25	1%	51E1	5322 116 53213
R 2101	RES.METAL FILM	MRS25	1%	10E	4822 116 52891
R 2102	RES.METAL FILM	MRS25	1%	10E	4822 116 52891
R 2201	RES.METAL FILM	MRS25	1%	75K	5322 116 53266
R 2202	RES.METAL FILM	MRS25	1%	12K1	4822 116 52957
R 2203	RES.METAL FILM	MRS25	1%	215K	5322 116 53425
R 2204	RES.CHIP	RC-02H	1%	10K	5322 116 80428
R 2205	RES.CHIP	MCR18	1%	2K2	4822 111 90248
R 2206	RES.METAL FILM	MRS25	1%	75K	5322 116 53266
R 2207	RES.METAL FILM	MRS25	1%	12K1	4822 116 52957
R 2208	RES.METAL FILM	MRS25	1%	215K	5322 116 53425
R 2209	RES.CHIP	RC-02H	1%	10K	5322 116 80428
R 2210	RES.CHIP	MCR18	1%	2K2	4822 111 90248
R 2211	RES.METAL FILM	MRS25	1%	5K62	5322 116 53495
R 2212	POTM.TRIMMER	0.3W	25%	10K	4822 105 10455
R 2213	RES.METAL FILM	MRS25	1%	23K7	5322 116 53537
R 2214	RES.CHIP	RC-02H	1%	10K	5322 116 80428
R 2215	RES.CHIP	MCR18	1%	2K2	4822 111 90248
R 2216	RES.METAL FILM	MRS25	1%	5K62	5322 116 53495
R 2222	RES.METAL FILM	MRS25	1%	1K96	5322 116 53237
R 2225	RES.METAL FILM	MRS25	1%	23K7	5322 116 53537
R 2230	RES.METAL FILM	MRS25	1%	147E	5322 116 53497
R 2231	RES.METAL FILM	MRS25	1%	422E	5322 116 53592
R 2232	RES.METAL FILM	MRS25	1%	383E	5322 116 53332
R 2234	RES.METAL FILM	MRS25	1%	31E6	5322 116 54964
R 2235	RES.METAL FILM	MRS25	1%	46E4	5322 116 53248
R 2236	RES.METAL FILM	MRS25	1%	681E	4822 116 53123
R 2237	RES.METAL FILM	MRS25	1%	383E	5322 116 53332
R 2239	RES.METAL FILM	MRS25	1%	348E	5322 116 53591
R 2241	RES.METAL FILM	MRS25	1%	1K	4822 116 53108
R 2242	RES.METAL FILM	MRS25	1%	383E	5322 116 53332
R 2243	RES.METAL FILM	MRS25	1%	681E	4822 116 53123
R 2244	RES.METAL FILM	MRS25	1%	31E6	5322 116 54964
R 2245	RES.METAL FILM	MRS25	1%	46E4	5322 116 53248
R 2246	RES.METAL FILM	MRS25	1%	422E	5322 116 53592
R 2247	RES.METAL FILM	MRS25	1%	383E	5322 116 53332
R 2251	RES.METAL FILM	MRS25	1%	75E	5322 116 53339
R 2252	RES.METAL FILM	MRS25	1%	750E	5322 116 53265
R 2253	RES.METAL FILM	MRS25	1%	750E	5322 116 53265
R 2254	RES.METAL FILM	MRS25	1%	75E	5322 116 53339
R 2255	RES.METAL FILM	MRS25	1%	287E	5322 116 53221
R 2301	RES.METAL FILM	MRS25	1%	19K6	5322 116 53258
R 2302	RES.METAL FILM	MRS25	1%	19K6	5322 116 53258
R 2303	RES.METAL FILM	MRS25	1%	5K62	5322 116 53495
R 2304	RES.METAL FILM	MRS25	1%	5K62	5322 116 53495
R 2311	RES.METAL FILM	MRS25	1%	2K87	5322 116 53513
R 2315	RES.METAL FILM	MRS25	1%	100E	5322 116 53126
R 2316	RES.METAL FILM	MRS25	1%	100E	5322 116 53126
R 2317	RES.METAL FILM	MRS25	1%	1K	4822 116 53108
R 2318	RES.METAL FILM	MRS25	1%	1K	4822 116 53108
R 2319	RES.METAL FILM	MRS25	1%	5E11	4822 116 52999
R 2324	RES.METAL FILM	MRS25	1%	5K62	5322 116 53495
R 2325	RES.METAL FILM	MRS25	1%	5K62	5322 116 53495
R 2326	RES.METAL FILM	MRS25	1%	2K87	5322 116 53513
R 2327	RES.METAL FILM	MRS25	1%	3K83	4822 116 53079
R 2328	RES.METAL FILM	MRS25	1%	2K87	5322 116 53513
R 2329	RES.METAL FILM	MRS25	1%	825E	5322 116 53541
R 2330	POTM.TRIMMER	0.3W	25%	10K	4822 105 10455
R 2333	RES.METAL FILM	MRS25	1%	5K62	5322 116 53495
R 2334	RES.METAL FILM	MRS25	1%	5K62	5322 116 53495
R 2335	RES.CHIP	RC-02H	1%	10K	5322 116 80428
R 2336	RES.METAL FILM	MRS25	1%	21E5	5322 116 53426
R 2337	RES.CHIP	MCR18	1%	160E	4822 111 90345
R 2338	RES.MET.GLAZED	MCR18	1%	4K3	5322 116 80605
R 2339	RES.NETWORK	MCR18	1%	390E	5322 111 91205
R 2341	RES.METAL FILM	MRS25	1%	21E5	5322 116 53426
R 2342	RES.CHIP	MCR18	1%	160E	4822 111 90345
R 2344	RES.CHIP	MCR18	1%	510E	4822 111 90245
R 2345	RES.NETWORK	MCR18	1%	100E	5322 111 91134
R 2348	RES.CHIP	MCR18	1%	8K2	5322 111 90118
R 2350	RES.NETWORK	MCR18	1%	5K1	5322 111 91471
R 2351	RES.CHIP	MCR18	1%	560E	5322 111 90113
R 2352	RES.CHIP	MCR18	1%	820E	4822 111 90171
R 2358	RES.CHIP	MCR18	1%	510E	4822 111 90245
R 2360	RES.NETWORK	MCR18	1%	100E	5322 111 91134
R 2361	RES.NETWORK	MCR18	1%	5K1	5322 111 91471
R 2365	RES.METAL FILM	MRS25	1%	23K7	5322 116 53537
R 2366	RES.METAL FILM	MRS25	1%	10K	4822 116 53022
R 2367	RES.METAL FILM	MRS25	1%	16K2	5322 116 53589
R 2369	RES.METAL FILM	MRS25	1%	68K1	5322 116 53338
R 2371	RES.METAL FILM	MRS25	1%	511E	5322 116 53135
R 2372	RES.METAL FILM	MRS25	1%	511E	5322 116 53135
R 2373	RES.METAL FILM	MRS25	1%	75K	5322 116 53266
R 2374	RES.METAL FILM	MRS25	1%	511E	5322 116 53135
R 2375	RES.METAL FILM	MRS25	1%	23K7	5322 116 53537
R 2376	RES.METAL FILM	VR25	10%		5322 116 51785
R 2377	RES.METAL FILM	VR25	10%		5322 116 51785
R 2378	RES.METAL FILM	VR25	10%		5322 116 51785
R 2379	RES.METAL FILM	VR25	10%		5322 116 51785
R 2380	RES.METAL FILM	MRS25	1%	750E	5322 116 53265
R 2381	RES.METAL FILM	MRS25	1%	2K61	5322 116 53327
R 2382	RES.METAL FILM	MRS25	1%	2K61	5322 116 53327
R 2383	RES.METAL FILM	MRS25	1%	1K	4822 116 53108
R 2384	RES.METAL FILM	MRS25	1%	750E	5322 116 53265
R 2386	RES.METAL FILM	MRS25	1%	1K	4822 116 53108
R 2387	RES.METAL FILM	MRS25	1%	750E	5322 116 53265
R 2388	RES.METAL FILM	MRS25	1%	1K	4822 116 53108
R 2389	RES.METAL FILM	MRS25	1%	1K	4822 116 53108

POSNR	DESCRIPTION				ORDERING CODE
R 2391	RES.METAL FILM	MRS25	1%	42E2	5322 116 53515
R 2393	RES.METAL FILM	MRS25	1%	3K48	4822 116 53315
R 2394	RES.METAL FILM	MRS25	1%	100E	5322 116 53126
R 2395	POTM.SLIDE	0.3W	25%	220E	5322 105 20031
R 2396	RES.METAL FILM	MRS25	1%	3K48	4822 116 53315
R 2397	RES.METAL FILM	MRS25	1%	42E2	5322 116 53515
R 2403	RES.METAL FILM	MRS25	1%	42E2	5322 116 53515
R 2404	RES.METAL FILM	MRS25	1%	1K33	5322 116 53512
R 2406	RES.METAL FILM	MRS25	1%	1K62	5322 116 53257
R 2407	POTM.SLIDE	0.3W	25%	220E	5322 105 20031
R 2408	RES.METAL FILM	MRS25	1%	1K33	5322 116 53512
R 2409	RES.METAL FILM	MRS25	1%	1K62	5322 116 53257
R 2410	POTM.SLIDE	0.3W	25%	1K	5322 105 20032
R 2411	RES.METAL FILM	MRS25	1%	42E2	5322 116 53515
R 2412	RES.METAL FILM	MRS25	1%	1K33	5322 116 53512
R 2416	RES.METAL FILM	MRS25	1%	1K	4822 116 53108
R 2418	RES.METAL FILM	MRS25	1%	5K62	5322 116 53495
R 2419	RES.METAL FILM	MRS25	1%	1K1	5322 116 53473
R 2420	RES.METAL FILM	MRS25	1%	133E	5322 116 53424
R 2421	RES.METAL FILM	MRS25	1%	5K62	5322 116 53495
R 2422	RES.CHIP	MCR18	1%	1K	4822 051 10102
R 2430	RES.METAL FILM	MRS25	1%	100K	4822 050 21004
R 2431	RES.METAL FILM	MRS25	1%	100K	4822 050 21004
R 2432	RES.METAL FILM	MRS25	1%	100K	4822 050 21004
R 2433	RES.METAL FILM	MRS25	1%	100K	4822 050 21004
R 2434	RES.METAL FILM	MRS25	1%	10K	4822 116 53022
R 2435	RES.METAL FILM	MRS25	1%	10K	4822 116 53022
R 2601	RES.METAL FILM	MRS25	1%	3K48	4822 116 53315
R 2602	RES.METAL FILM	MRS25	1%	5E11	4822 116 52999
R 2603	RES.METAL FILM	MRS25	1%	5K11	5322 116 53494
R 2604	RES.NETWORK	MCR18	1%	5K1	5322 111 91471
R 2605	RES.METAL FILM	MRS25	1%	12K1	4822 116 52957
R 2606	RES.METAL FILM	MRS25	1%	1E	4822 050 21008
R 2610	RES.METAL FILM	MRS25	1%	10K	4822 116 53022
R 2611	RES.METAL FILM	MRS25	1%	1K	4822 116 53108
R 2621	RES.METAL FILM	MRS25	1%	422E	5322 116 53592
R 2622	RES.METAL FILM	MRS25	1%	681E	4822 116 53123
R 2623	RES.METAL FILM	MRS25	1%	1K1	5322 116 53473
R 2624	RES.METAL FILM	MRS25	1%	3K48	4822 116 53315
R 2625	RES.METAL FILM	MRS25	1%	681E	4822 116 53123
R 2626	RES.METAL FILM	MRS25	1%	6K81	5322 116 53252
R 2627	RES.METAL FILM	MRS25	1%	287E	5322 116 53221
R 2628	RES.METAL FILM	MRS25	1%	2K37	5322 116 53503
R 2629	RES.METAL FILM	MRS25	1%	10K	4822 116 53022
R 2631	RES.METAL FILM	MRS25	1%	10K	4822 116 53022
R 2632	RES.METAL FILM	MRS25	1%	383E	5322 116 53332
R 2635	RES.METAL FILM	MRS25	1%	10K	4822 116 53022
R 2701	RES.METAL FILM	MRS25	1%	1E	4822 050 21008
R 2702	RES.METAL FILM	MRS25	1%	26E1	5322 116 53723
R 2704	RES.METAL FILM	MRS25	1%	5E11	4822 116 52999
R 2712	RES.METAL FILM	MRS25	1%	5E11	4822 116 52999
R 2713	RES.METAL FILM	MRS25	1%	5E11	4822 116 52999
R 2714	RES.METAL FILM	MRS25	1%	5E11	4822 116 52999
R 2721	RES.METAL FILM	MRS25	1%	5E11	4822 116 52999
R 2722	RES.METAL FILM	MRS25	1%	1E	4822 050 21008
R 2723	RES.METAL FILM	MRS25	1%	5E11	4822 116 52999
R 2724	RES.METAL FILM	MRS25	1%	5E11	4822 116 52999
R 2740	RES.METAL FILM	MRS25	1%	5E11	4822 116 52999
R 2741	RES.METAL FILM	MRS25	1%	31E6	5322 116 54964
R 2742	RES.METAL FILM	MRS25	1%	5E11	4822 116 52999
R 2801	RES.METAL FILM	RC-02H	1%	1K1	4822 116 82238
R 2802	RES.CHIP	MCR18	1%	1K	4822 051 10102
R 2803	RES.CHIP	MCR18	1%	2K7	4822 111 90569
R 2804	RES.CHIP	MCR18	1%	1K	4822 051 10102
R 2806	RES.NETWORK	MCR18	1%	5K1	5322 111 91471
R 2807	RES.CHIP	MCR18	1%	1K	4822 051 10102
R 2808	RES.CHIP	MCR18	1%	2K7	4822 111 90569
R 2809	RES.CHIP	MCR18	1%	510E	4822 111 90245
R 2811	RES.CHIP	MCR18	1%	510E	4822 111 90245
R 2812	RES.CHIP	MCR18	1%	510E	4822 111 90245
R 2813	RES.CHIP	MCR18	1%	510E	4822 111 90245
R 2814	RES.CHIP	MCR18	1%	1K	4822 051 10102
R 2816	RES.CHIP	MCR18	1%	1K	4822 051 10102
R 2817	RES.CHIP	MCR18	1%	1K	4822 051 10102
R 2818	RES.CHIP	MCR18	1%	1K	4822 051 10102
R 2819	RES.METAL FILM	RC-02H	1%	1K1	4822 116 82238
R 2821	RES.MET.GLAZED	MCR18	1%	1K6	5322 116 80596
R 2822	RES.CHIP	MCR18	1%	1K	4822 051 10102
R 2823	RES.CHIP	MCR18	1%	1K	4822 051 10102
R 2824	RES.CHIP	MCR18	1%	1K	4822 051 10102
R 2826	RES.METAL FILM	MCR18	1%	2K	5322 116 80858
R 2827	RES.METAL FILM	MCR18	1%	2K	5322 116 80858
R 2828	RES.METAL FILM	MCR18	1%	2K	5322 116 80858
R 2829	RES.NETWORK	MCR18	1%	390E	5322 111 91205
R 2831	RES.NETWORK	MCR18	1%	390E	5322 111 91205
R 2832	RES.CHIP	MCR18	1%	2K7	4822 111 90569
R 2833	RES.CHIP	MCR18	1%	2K7	4822 111 90569
R 2834	RES.NETWORK	MCR18	1%	390E	5322 111 91205
R 2836	RES.NETWORK	MCR18	1%	390E	5322 111 91205
R 3001	RES.METAL FILM	MRS25	1%	147E	5322 116 53497
R 3002	RES.METAL FILM	MRS25	1%	316E	5322 116 53499
R 3003	RES.METAL FILM	MRS25	1%	1K47	5322 116 53185
R 3004	RES.METAL FILM	MRS25	1%	422E	5322 116 53592
R 3006	RES.METAL FILM	MRS25	1%	2K37	5322 116 53503
R 3007	POTM.SLIDE	0.3W	25%	2K2	5322 105 20033
R 3008	RES.METAL FILM	MRS25	1%	121E	4822 116 52955
R 3009	RES.METAL FILM	MRS25	1%	3K83	4822 116 53079
R 3011	RES.METAL FILM	MRS25	1%	121E	4822 116 52955
R 3012	RES.METAL FILM	MRS25	1%	316E	5322 116 53499
R 3013	POTM.TRIMMER	0.3W	25%	10K	4822 105 10455
R 3014	RES.METAL FILM	MRS25	1%	2K87	5322 116 53513
R 3015	RES.METAL FILM	MRS25	1%	316E	5322 116 53499
R 3016	RES.METAL FILM	MRS25	1%	2K37	5322 116 53503
R 3017	POTM.SLIDE	0.3W	25%	22K	5322 105 20035
R 3018	RES.METAL FILM	MRS25	1%	8K25	5322 116 53267
R 3020	RES.METAL FILM	MRS25	1%	10E	4822 116 52891
R 3021	RES.METAL FILM	MRS25	1%	464E	5322 116 53232
R 3022	RES.METAL FILM	MRS25	1%	750E	5322 116 53265
R 3023	RES.METAL FILM	MRS25	1%	348E	5322 116 53591
R 3024	RES.METAL FILM	MRS25	1%	750E	5322 116 53265
R 3025	RES.METAL FILM	MRS25	1%	10E	4822 116 52891
R 3026	RES.METAL FILM	MRS25	1%	464E	5322 116 53232

POSNR	DESCRIPTION				ORDERING CODE
R 3027	RES.METAL FILM	MRS25	1%	42E2	5322 116 53515
R 3028	RES.METAL FILM	MRS25	1%	42E2	5322 116 53515
R 3029	RES.METAL FILM	MRS25	1%	3K16	4822 116 53021
R 3031	RES.METAL FILM	MRS25	1%	402E	5322 116 53639
R 3032	RES.METAL FILM	MRS25	1%	31E6	5322 116 54964
R 3033	RES.METAL FILM	MRS25	1%	100E	5322 116 53126
R 3034	RES.METAL FILM	MRS25	1%	162E	5322 116 53523
R 3036	POTM.SLIDE	0.3W	25%	100E	5322 105 20029
R 3037	RES.METAL FILM	MRS25	1%	100E	5322 116 53126
R 3038	POTM.SLIDE	0.3W	25%	470E	5322 105 20028
R 3039	RES.METAL FILM	MRS25	1%	42E2	5322 116 53515
R 3041	RES.METAL FILM	MRS25	1%	316E	5322 116 53499
R 3042	RES.METAL FILM	MRS25	1%	110E	4822 116 52906
R 3043	RES.METAL FILM	MRS25	1%	110E	4822 116 52906
R 3044	RES.METAL FILM	MRS25	1%	110E	4822 116 52906
R 3046	RES.METAL FILM	MRS25	1%	110E	4822 116 52906
R 3047	RES.METAL FILM	MRS25	1%	42E2	5322 116 53515
R 3048	RES.METAL FILM	MRS25	1%	42E2	5322 116 53515
R 3049	RES.METAL FILM	MRS25	1%	51K1	4822 116 53121
R 3050	RES.METAL FILM	MRS25	1%	42E2	5322 116 53515
R 3051	RES.METAL FILM	MRS25	1%	51K1	4822 116 53121
R 3052	RES.METAL FILM	MRS25	1%	42E2	5322 116 53515
R 3060	RES.METAL FILM	MRS25	1%	110E	4822 116 52906
R 3061	RES.METAL FILM	MRS25	1%	110E	4822 116 52906
R 3062	RES.METAL FILM	MRS25	1%	110E	4822 116 52906
R 3063	RES.METAL FILM	MRS25	1%	110E	4822 116 52906
R 3064	RES.METAL FILM	MRS25	1%	110E	4822 116 52906
R 3066	RES.METAL FILM	MRS25	1%	110E	4822 116 52906
R 3067	RES.METAL FILM	MRS25	1%	110E	4822 116 52906
R 3068	RES.METAL FILM	MRS25	1%	110E	4822 116 52906
R 3100	RES.METAL FILM	MRS25	1%	42E2	5322 116 53515
R 3101	RES.METAL FILM	MRS25	1%	5K62	5322 116 53495
R 3102	RES.METAL FILM	MRS25	1%	562E	5322 116 53656
R 3103	RES.METAL FILM	MRS25	1%	1K21	4822 116 52956
R 3104	RES.METAL FILM	MRS25	1%	6K81	5322 116 53252
R 3106	RES.METAL FILM	MRS25	1%	42E2	5322 116 53515
R 3107	RES.METAL FILM	MRS25	1%	2K87	5322 116 53513
R 3108	RES.METAL FILM	MRS25	1%	825E	5322 116 53541
R 3109	RES.METAL FILM	MRS25	1%	6K19	5322 116 53263
R 3110	RES.METAL FILM	MRS25	1%	42E2	5322 116 53515
R 3111	RES.METAL FILM	MRS25	1%	42E2	5322 116 53515
R 3112	RES.METAL FILM	MRS25	1%	7K5	4822 116 53028
R 3113	RES.METAL FILM	MRS25	1%	1K21	4822 116 52956
R 3114	RES.METAL FILM	MRS25	1%	5K62	5322 116 53495
R 3115	RES.METAL FILM	MRS25	1%	42E2	5322 116 53515
R 3116	RES.METAL FILM	MRS25	1%	562E	5322 116 53656
R 3117	RES.METAL FILM	MRS25	1%	4K64	5322 116 53213
R 3118	POTM.SLIDE	0.3W	25%	1K	5322 105 20032
R 3119	RES.METAL FILM	MRS25	1%	4K64	5322 116 53213
R 3120	RES.METAL FILM	MRS25	1%	42E2	5322 116 53515
R 3121	RES.METAL FILM	MRS25	1%	15K4	5322 116 53234
R 3122	RES.METAL FILM	MRS25	1%	2K37	5322 116 53503
R 3124	RES.METAL FILM	MRS25	1%	619E	5322 116 53337
R 3125	RES.METAL FILM	MRS25	1%	26E1	5322 116 53723
R 3126	RES.METAL FILM	MRS25	1%	14K7	4822 116 53531
R 3127	RES.METAL FILM	MRS25	1%	1K33	5322 116 53512
R 3128	RES.METAL FILM	MRS25	1%	825E	5322 116 53541
R 3129	RES.METAL FILM	MRS25	1%	1K1	5322 116 53473
R 3130	RES.METAL FILM	MRS25	1%	26E1	5322 116 53723
R 3131	RES.METAL FILM	MRS25	1%	1K33	5322 116 53512
R 3132	RES.METAL FILM	MRS25	1%	825E	5322 116 53541
R 3133	RES.METAL FILM	MRS25	1%	6K19	5322 116 53263
R 3134	RES.METAL FILM	MRS25	1%	14K7	4822 116 53531
R 3136	RES.METAL FILM	MRS25	1%	1K	4822 116 53108
R 3137	RES.METAL FILM	MRS25	1%	15K4	5322 116 53234
R 3138	RES.METAL FILM	MRS25	1%	2K37	5322 116 53503
R 3139	RES.METAL FILM	MRS25	1%	619E	5322 116 53337
R 3141	RES.METAL FILM	MRS25	1%	316E	5322 116 53499
R 3142	RES.METAL FILM	MRS25	1%	316E	5322 116 53499
R 3143	RES.METAL FILM	MRS25	1%	10E	4822 116 52891
R 3144	RES.METAL FILM	MRS25	1%	10E	4822 116 52891
R 3147	RES.N.T.C.	0.5W	10%	3K3	5322 116 30234
R 3148	RES.METAL FILM	MRS25	1%	9K09	5322 116 53253
R 3149	RES.METAL FILM	MRS25	1%	511E	5322 116 53135
R 3200	RES.METAL FILM	MRS25	1%	6K81	5322 116 53252
R 3201	RES.METAL FILM	MRS25	1%	1K21	4822 116 52956
R 3202	RES.METAL FILM	MRS25	1%	100E	5322 116 53126
R 3203	RES.METAL FILM	MRS25	1%	16K2	5322 116 53589
R 3204	RES.METAL FILM	MRS25	1%	562E	5322 116 53656
R 3205	RES.METAL FILM	MRS25	1%	4K64	5322 116 53213
R 3206	RES.METAL FILM	MRS25	1%	4K64	5322 116 53213
R 3207	RES.METAL FILM	MRS25	1%	82K5	5322 116 53581
R 3208	RES.METAL FILM	MRS25	1%	7K5	4822 116 53028
R 3209	RES.METAL FILM	MRS25	1%	1K	4822 116 53108
R 3210	RES.METAL FILM	MRS25	1%	42E2	5322 116 53515
R 3211	RES.METAL FILM	MRS25	1%	10K	4822 116 53022
R 3212	RES.METAL FILM	MRS25	1%	1K47	5322 116 53185
R 3213	RES.METAL FILM	MRS25	1%	23K7	5322 116 53537
R 3214	RES.METAL FILM	MRS25	1%	31K6	5322 116 53262
R 3215	RES.METAL FILM	MRS25	1%	4K64	5322 116 53213
R 3216	RES.METAL FILM	MRS25	1%	178K	5322 116 53555
R 3217	RES.METAL FILM	MRS25	1%	511E	5322 116 53135
R 3218	RES.METAL FILM	MRS25	1%	61K9	5322 116 53233
R 3219	RES.METAL FILM	MRS25	1%	1M	4822 116 52843
R 3221	RES.METAL FILM	MRS25	1%	100E	5322 116 53126
R 3222	RES.METAL FILM	MRS25	1%	100K	4822 050 21004
R 3223	RES.METAL FILM	MRS25	1%	38K3	5322 116 55369
R 3224	RES.METAL FILM	MRS25	1%	2K37	5322 116 53503
R 3226	RES.METAL FILM	MRS25	1%	100E	5322 116 53126
R 3250	RES.METAL FILM	MRS25	1%	2K37	5322 116 53503
R 3251	RES.METAL FILM	MRS25	1%	1M	4822 116 52843
R 3253	RES.METAL FILM	MRS25	1%	75K	5322 116 53266
R 3254	RES.METAL FILM	MRS25	1%	1K	4822 116 53108
R 3256	RES.METAL FILM	MRS25	1%	178K	5322 116 53555
R 3257	RES.METAL FILM	MRS25	1%	825K	5322 116 53341
R 3258	RES.HI-TENSION	VR25	5%	3M3	4822 110 72201
R 3259	RES.HI-TENSION	VR25	5%	3M3	4822 110 72201
R 3261	RES.HI-TENSION	VR25	5%	3M3	4822 110 72201
R 3263	RES.HI-TENSION	VR25	5%	3M3	4822 110 72201
R 3267	POTM.SLIDE		25%	47K	5322 105 20037
R 3268	RES.METAL FILM	MRS25	1%	681K	5322 116 53593

POSNR	DESCRIPTION				ORDERING CODE
R 3269	RES.METAL FILM	MRS25	1%	15K4	5322 116 53234
R 3270	RES.METAL FILM	MRS25	1%	23K7	5322 116 53537
R 3271	RES.METAL FILM	MRS25	1%	14K7	4822 116 53531
R 3273	RES.METAL FILM	MRS25	1%	215K	5322 116 53425
R 3301	RES.METAL FILM	MRS25	1%	10E	4822 116 52891
R 3302	RES.METAL FILM	MRS25	1%	1E	4822 050 21008
R 3303	RES.METAL FILM	MRS25	1%	5E11	4822 116 52999
R 3304	RES.METAL FILM	MRS25	1%	5E11	4822 116 52999
R 3306	RES.METAL FILM	MRS25	1%	2K87	5322 116 53513
R 3308	RES.METAL FILM	MRS25	1%	10E	4822 116 52891
R 3309	RES.METAL FILM	MRS25	1%	5E11	4822 116 52999
R 3311	RES.METAL FILM	MRS25	1%	5E11	4822 116 52999
R 3312	RES.METAL FILM	MRS25	1%	5E11	4822 116 52999
R 3313	RES.METAL FILM	MRS25	1%	10E	4822 116 52891
R 4001	RES.METAL FILM	MRS25	1%	51E1	5322 116 53213
R 4002	RES.METAL FILM	MRS25	1%	51E1	5322 116 53213
R 4003	RES.METAL FILM	MRS25	1%	2K61	5322 116 53327
R 4004	POTM.SLIDE	0.3W	25%	1K	5322 105 20032
R 4006	RES.METAL FILM	MRS25	1%	10K	4822 116 53022
R 4007	RES.METAL FILM	MRS25	1%	100E	5322 116 53126
R 4008	RES.METAL FILM	MRS25	1%	100E	5322 116 53126
R 4009	RES.METAL FILM	MRS25	1%	1K	4822 116 53108
R 4011	RES.METAL FILM	MRS25	1%	2K15	5322 116 53239
R 4012	RES.METAL FILM	MRS25	1%	100E	5322 116 53126
R 4013	RES.METAL FILM	MRS25	1%	100E	5322 116 53126
R 4014	RES.METAL FILM	MRS25	1%	909E	4822 116 53533
R 4016	RES.METAL FILM	MRS25	1%	909E	4822 116 53533
R 4017	RES.METAL FILM	MRS25	1%	100E	5322 116 53126
R 4019	RES.METAL FILM	MRS25	1%	51E1	5322 116 53213
R 4021	RES.METAL FILM	MRS25	1%	1K47	5322 116 53185
R 4022	RES.METAL FILM	MRS25	1%	511E	5322 116 53135
R 4023	RES.METAL FILM	MRS25	1%	562E	5322 116 53656
R 4026	RES.METAL FILM	MRS25	1%	909E	4822 116 53533
R 4027	RES.METAL FILM	MRS25	1%	5K62	5322 116 53495
R 4028	RES.METAL FILM	MRS25	1%	1K	4822 116 53108
R 4029	RES.METAL FILM	MRS25	1%	2K37	5322 116 53503
R 4031	RES.METAL FILM	MRS25	1%	1M	4822 116 52843
R 4032	RES.METAL FILM	MRS25	1%	5K11	5322 116 53494
R 4033	RES.METAL FILM	MRS25	1%	2K61	5322 116 53327
R 4041	RES.METAL FILM	MRS25	1%	5K11	5322 116 53494
R 4042	RES.METAL FILM	MRS25	1%	3K16	4822 116 53021
R 4043	RES.METAL FILM	MRS25	1%	5K11	5322 116 53494
R 4044	RES.METAL FILM	MRS25	1%	681K	5322 116 53593
R 4046	RES.METAL FILM	MRS25	1%	10K	4822 116 53022
R 4047	RES.METAL FILM	MRS25	1%	12K1	4822 116 52957
R 4086	RES.METAL FILM	MRS25	1%	909E	4822 116 53533
R 4101	RES.METAL FILM	MRS25	1%	100K	4822 050 21004
R 4102	RES.METAL FILM	MRS25	1%	4K64	5322 116 53213
R 4103	RES.METAL FILM	MRS25	1%	11K	4822 116 52907
R 4104	RES.METAL FILM	MRS25	1%	46K4	5322 116 53314
R 4106	RES.METAL FILM	MRS25	1%	422E	5322 116 53592
R 4107	POTM.TRIMMER	0.3W	25%	10K	4822 105 10455
R 4108	POTM.TRIMMER	0.3W	25%	10K	4822 105 10455
R 4109	RES.METAL FILM	MRS25	1%	5K11	5322 116 53494
R 4111	RES.METAL FILM	MRS25	1%	12K1	4822 116 52957
R 4117	RES.METAL FILM	MRS25	1%	3K16	4822 116 53021
R 4118	RES.METAL FILM	1/4W	.25%	50E	5322 116 53405
R 4119	RES.METAL FILM	1/4W	.25%	50E	5322 116 53405
R 4120	RES.METAL FILM	MRS25	1%	1K	4822 116 53108
R 4121	RES.METAL FILM	1/4W	.25%	150E	5322 116 53399
R 4122	RES.METAL FILM	1/4W	.25%	250E	5322 116 53406
R 4123	RES.METAL FILM	1/4W	.25%	500E	5322 116 53408
R 4124	RES.METAL FILM	1/4W	.25%	1K5	5322 116 53401
R 4125	RES.METAL FILM	MRS25	1%	100E	5322 116 53126
R 4126	RES.METAL FILM	MRS25	1%	9K09	5322 116 53253
R 4127	RES.METAL FILM	MRS25	1%	1K62	5322 116 53257
R 4129	RES.METAL FILM	MRS25	1%	1M	4822 116 52843
R 4130	RES.METAL FILM	MRS25	1%	1K	4822 116 53108
R 4131	RES.METAL FILM	MRS25	1%	5K11	5322 116 53494
R 4132	RES.METAL FILM	MRS25	1%	5K11	5322 116 53494
R 4134	RES.METAL FILM	MRS25	1%	10K	4822 116 53022
R 4135	RES.METAL FILM	MRS25	1%	1K	4822 116 53108
R 4136	RES.METAL FILM	MRS25	1%	10K	4822 116 53022
R 4137	RES.METAL FILM	MRS25	1%	14K7	4822 116 53531
R 4138	RES.METAL FILM	MRS25	1%	5E11	4822 116 52999
R 4139	RES.METAL FILM	MRS25	1%	10K	4822 116 53022
R 4140	RES.METAL FILM	MRS25	1%	10K	4822 116 53022
R 4141	RES.METAL FILM	MRS25	1%	14K7	4822 116 53531
R 4142	RES.METAL FILM	MRS25	1%	100E	5322 116 53126
R 4143	RES.METAL FILM	1/4W	0.1%	20K	5322 116 52697
R 4144	RES.METAL FILM	1/4W	0.1%	202E	5322 116 53413
R 4145	RES.METAL FILM	MRS25	1%	1K	4822 116 53108
R 4146	RES.METAL FILM	MRS25	1%	10K	4822 116 53022
R 4147	RES.METAL FILM	MRS25	1%	511E	5322 116 53135
R 4148	RES.METAL FILM	MRS25	1%	21K5	5322 116 53241
R 4149	RES.METAL FILM	MRS25	1%	31E6	5322 116 54964
R 4150	RES.METAL FILM	MRS25	1%	9E09	5322 116 53516
R 4151	RES.METAL FILM	MRS25	1%	2K61	5322 116 53327
R 4152	RES.METAL FILM	MRS25	1%	162E	5322 116 53523
R 4153	RES.METAL FILM	MRS25	1%	1K1	5322 116 53473
R 4154	RES.METAL FILM	MRS25	1%	1K78	5322 116 53208
R 4155	RES.METAL FILM	MRS25	1%	2K15	5322 116 53239
R 4156	RES.METAL FILM	MRS25	1%	1M	4822 116 52843
R 4157	RES.METAL FILM	MRS25	1%	1E	4822 050 21008
R 4158	RES.METAL FILM	MRS25	1%	1M	4822 116 52843
R 4159	RES.METAL FILM	MRS25	1%	2K15	5322 116 53239
R 4160	RES.METAL FILM	MRS25	1%	100E	5322 116 53126
R 4161	RES.METAL FILM	MRS25	1%	10K	4822 116 53022
R 4162	RES.METAL FILM	MRS25	1%	100E	5322 116 53126
R 4163	RES.METAL FILM	MRS25	1%	5E11	4822 116 52999
R 4164	RES.METAL FILM	MRS25	1%	100E	5322 116 53126
R 4253	RES.METAL FILM	MRS25	1%	1K	4822 116 53108
R 4258	RES.METAL FILM	MRS25	1%	4K64	5322 116 53213
R 4259	RES.METAL FILM	MRS25	1%	4K64	5322 116 53213
R 4260	POTM.SLIDE	0.3W	25%	1K	5322 105 20032
R 4261	RES.METAL FILM	MRS25	1%	10K	4822 116 53022
R 4262	RES.METAL FILM	MRS25	1%	10K	4822 116 53022
R 4263	RES.METAL FILM	MRS25	1%	5K11	5322 116 53494
R 4265	RES.METAL FILM	MRS25	1%	100E	5322 116 53126
R 4301	RES.METAL FILM	MRS25	1%	51K1	4822 116 53121
R 4302	RES.METAL FILM	MRS25	1%	51K1	4822 116 53121

POSNR	DESCRIPTION				ORDERING CODE
R 4303	RES.METAL FILM	MRS25	1%	6K81	5322 116 53252
R 4304	RES.METAL FILM	MRS25	1%	5K11	5322 116 53494
R 4305	RES.METAL FILM	MRS25	1%	51K1	4822 116 53121
R 4306	RES.METAL FILM	MRS25	1%	681E	4822 116 53123
R 4307	RES.METAL FILM	MRS25	1%	5K11	5322 116 53494
R 4308	RES.METAL FILM	MRS25	1%	10K	4822 116 53022
R 4309	RES.METAL FILM	MRS25	1%	8K25	5322 116 53267
R 4310	RES.METAL FILM	MRS25	1%	100E	5322 116 53126
R 4311	RES.METAL FILM	MRS25	1%	10K	4822 116 53022
R 4312	RES.METAL FILM	MRS25	1%	9K09	5322 116 53253
R 4313	RES.METAL FILM	MRS25	1%	7K5	4822 116 53028
R 4314	RES.METAL FILM	MRS25	1%	8K25	5322 116 53267
R 4330	RES.METAL FILM	MRS25	1%	5K11	5322 116 53494
R 4331	RES.METAL FILM	MRS25	1%	21K5	5322 116 53241
R 4332	RES.METAL FILM	MRS25	1%	4K22	5322 116 53246
R 4334	RES.METAL FILM	MRS25	1%	2K15	5322 116 53239
R 4404	RES.METAL FILM	MRS25	1%	2K37	5322 116 53503
R 4411	RES.METAL FILM	MRS25	1%	2K37	5322 116 53503
R 4501	RES.METAL FILM	MRS25	1%	13K3	5322 116 53489
R 4502	RES.METAL FILM	MRS25	1%	4K22	5322 116 53246
R 4503	RES.METAL FILM	MRS25	1%	6K81	5322 116 53252
R 4504	RES.METAL FILM	MRS25	1%	13K3	5322 116 53489
R 4505	RES.METAL FILM	MRS25	1%	511E	5322 116 53135
R 4506	RES.METAL FILM	MRS25	1%	2K15	5322 116 53239
R 4507	RES.METAL FILM	MRS25	1%	750E	5322 116 53265
R 4508	RES.METAL FILM	MRS25	1%	11K	4822 116 52907
R 4509	RES.METAL FILM	MRS25	1%	2K15	5322 116 53239
R 4513	RES.METAL FILM	MRS25	1%	1K47	5322 116 53185
R 4521	RES.METAL FILM	MRS25	1%	16K2	5322 116 53589
R 4522	RES.METAL FILM	MRS25	1%	23K7	5322 116 53537
R 4523	RES.METAL FILM	MRS25	1%	16K2	5322 116 53589
R 4524	RES.METAL FILM	MRS25	1%	14K7	4822 116 53531
R 4526	RES.METAL FILM	MRS25	1%	2K37	5322 116 53503
R 4527	RES.METAL FILM	MRS25	1%	19K6	5322 116 53258
R 4528	RES.METAL FILM	MRS25	1%	5K62	5322 116 53495
R 4529	RES.METAL FILM	MRS25	1%	21K5	5322 116 53241
R 4531	RES.METAL FILM	MRS25	1%	10K	4822 116 53022
R 4532	RES.METAL FILM	MRS25	1%	10K	4822 116 53022
R 4533	RES.METAL FILM	MRS25	1%	3K48	4822 116 53315
R 4601	RES.METAL FILM	MRS25	1%	2K37	5322 116 53503
R 4602	RES.METAL FILM	MRS25	1%	26K1	5322 116 53261
R 4603	RES.METAL FILM	MRS25	1%	23K7	5322 116 53537
R 4604	RES.METAL FILM	MRS25	1%	100K	4822 050 21004
R 4606	RES.METAL FILM	MRS25	1%	909E	4822 116 53533
R 4607	RES.METAL FILM	MRS25	1%	100E	5322 116 53126
R 4608	RES.METAL FILM	MRS25	1%	1K	4822 116 53108
R 4609	RES.METAL FILM	MRS25	1%	42E2	5322 116 53515
R 4611	RES.METAL FILM	MRS25	1%	10K	4822 116 53022
R 4612	RES.METAL FILM	MRS25	1%	7K5	4822 116 53028
R 4613	RES.METAL FILM	MRS25	1%	10K	4822 116 53022
R 4614	RES.METAL FILM	MRS25	1%	51K1	4822 116 53121
R 4616	POTM.SLIDE	0.3W	25%	1K	5322 105 20032
R 4617	RES.METAL FILM	MRS25	1%	6K81	5322 116 53252
R 4618	RES.METAL FILM	MRS25	1%	11K	4822 116 52907
R 4619	RES.METAL FILM	MRS25	1%	8K25	5322 116 53267
R 4620	RES.METAL FILM	MRS25	1%	7K5	4822 116 53028
R 4621	RES.METAL FILM	MRS25	1%	909E	4822 116 53533
R 4622	RES.METAL FILM	MRS25	1%	100E	5322 116 53126
R 4625	RES.METAL FILM	MRS25	1%	100E	5322 116 53126
R 4626	RES.METAL FILM	MRS25	1%	100E	5322 116 53126
R 4627	RES.METAL FILM	MRS25	1%	10K	4822 116 53022
R 4628	RES.METAL FILM	MRS25	1%	1K	4822 116 53108
R 4629	RES.METAL FILM	MRS25	1%	8K25	5322 116 53267
R 4631	RES.METAL FILM	MRS25	1%	1K	4822 116 53108
R 4632	RES.METAL FILM	MRS25	1%	100E	5322 116 53126
R 4633	RES.METAL FILM	MRS25	1%	1K	4822 116 53108
R 4634	RES.METAL FILM	MRS25	1%	1K	4822 116 53108
R 4636	RES.METAL FILM	MRS25	1%	1M	4822 116 52843
R 4639	RES.METAL FILM	MRS25	1%	383E	5322 116 53332
R 4701	RES.METAL FILM	MRS25	1%	42E2	5322 116 53515
R 4703	RES.METAL FILM	MRS25	1%	562E	5322 116 53656
R 4705	RES.METAL FILM	MRS25	1%	1K	4822 116 53108
R 4706	RES.METAL FILM	MRS25	1%	100E	5322 116 53126
R 4707	RES.METAL FILM	MRS25	1%	511E	5322 116 53135
R 4708	RES.METAL FILM	MRS25	1%	2K87	5322 116 53513
R 4709	RES.METAL FILM	MRS25	1%	681E	4822 116 53123
R 4711	RES.METAL FILM	MRS25	1%	6K19	5322 116 53263
R 4712	RES.METAL FILM	MRS25	1%	511E	5322 116 53135
R 4713	RES.METAL FILM	MRS25	1%	1M	4822 116 52843
R 4714	RES.METAL FILM	MRS25	1%	1M	4822 116 52843
R 4716	RES.METAL FILM	MRS25	1%	6K81	5322 116 53252
R 4717	RES.METAL FILM	MRS25	1%	8K25	5322 116 53267
R 4718	RES.METAL FILM	MRS25	1%	1K	4822 116 53108
R 4719	RES.METAL FILM	MRS25	1%	100E	5322 116 53126
R 4721	POTM.SLIDE	0.3W	25%	1K	5322 105 20032
R 4722	RES.METAL FILM	MRS25	1%	46K4	5322 116 53314
R 4723	RES.METAL FILM	MRS25	1%	681K	5322 116 53593
R 4724	RES.METAL FILM	MRS25	1%	42E2	5322 116 53515
R 4725	RES.METAL FILM	MRS25	1%	4K22	5322 116 53246
R 4726	RES.METAL FILM	MRS25	1%	100K	4822 050 21004
R 4727	RES.METAL FILM	MRS25	1%	6K81	5322 116 53252
R 4728	RES.METAL FILM	MRS25	1%	562E	5322 116 53656
R 4801	RES.METAL FILM	MRS25	1%	5E11	4822 116 52999
R 4804	RES.METAL FILM	MRS25	1%	5E11	4822 116 52999
R 4807	RES.METAL FILM	MRS25	1%	5E11	4822 116 52999
R 4809	RES.METAL FILM	MRS25	1%	5E11	4822 116 52999
R 4819	RES.METAL FILM	MRS25	1%	5E11	4822 116 52999
R 4820	RES.METAL FILM	MRS25	1%	5E11	4822 116 52999
R 4822	RES.METAL FILM	MRS25	1%	5E11	4822 116 52999
R 4825	RES.METAL FILM	MRS25	1%	5E11	4822 116 52999
R 4829	RES.METAL FILM	MRS25	1%	5E11	4822 116 52999
R 4831	RES.METAL FILM	MRS25	1%	5E11	4822 116 52999
R 4833	RES.METAL FILM	MRS25	1%	5E11	4822 116 52999
R 4835	RES.METAL FILM	MRS25	1%	5E11	4822 116 52999
R 4836	RES.METAL FILM	MRS25	1%	5E11	4822 116 52999
R 4841	RES.METAL FILM	MRS25	1%	10K	4822 116 53022
R 4891	RES.METAL FILM	MRS25	1%	5E11	4822 116 52999
R 4893	RES.METAL FILM	MRS25	1%	5E11	4822 116 52999
R 4894	RES.METAL FILM	MRS25	1%	5E11	4822 116 52999
R 4901	RES.METAL FILM	MRS25	1%	562E	5322 116 53656
R 4904	RES.METAL FILM	MRS25	1%	1E	4822 050 21008

POSNR	DESCRIPTION				ORDERING CODE
R 5001	POTM.CARB.TRACK	CRC17	20%	10K	5322 101 30546
R 5002	POTM.CARB.TRACK	CRC17	20%	10K	5322 101 30547
R 5003	POTM.CARB.TRACK	CRC17	20%	10K	5322 101 30546
R 5004	POTM.CARB.TRACK	CRC17	20%	10K	5322 101 30546
R 5101	RES.CHIP	RC-01	5%	5E6	4822 111 90394
R 5102	RES.CHIP	MCR18	1%	1K	4822 051 10102
R 5104	RES.METAL FILM	MCR18	1%	430E	5322 116 80863
R 5105	RES.MET.GLAZED	MCR18	1%	200E	5322 116 80599
R 5106	RES.CHIP	MCR18	1%	33E	4822 111 90357
R 5107	RES.CHIP	MCR18	1%	1K	4822 051 10102
R 5108	RES.NETWORK	MCR18	1%	51E	5322 111 91352
R 5109	RES.METAL FILM	MCR18	1%	240E	5322 116 80859
R 5110	RES.METAL FILM	MCR18	1%	430E	5322 116 80863
R 5111	RES.CHIP	RC-01	5%	5E6	4822 111 90394
R 5112	RES.CHIP	MCR18	1%	1K	4822 051 10102
R 5113	RES.CHIP	MCR18	1%	2K2	4822 111 90248
R 5114	RES.METAL FILM	MCR18	1%	430E	5322 116 80863
R 5115	RES.MET.GLAZED	MCR18	1%	200E	5322 116 80599
R 5116	RES.CHIP	MCR18	1%	33E	4822 111 90357
R 5117	RES.CHIP	MCR18	1%	1K	4822 051 10102
R 5118	RES.NETWORK	MCR18	1%	51E	5322 111 91352
R 5119	RES.METAL FILM	MCR18	1%	240E	5322 116 80859
R 5121	RES.METAL FILM	MCR18	1%	430E	5322 116 80863
R 5122	RES.NETWORK	MCR18	1%	100E	5322 111 91134
R 5123	RES.NETWORK	MCR18	1%	51E	5322 111 91352
R 5124	RES.CHIP	MCR18	1%	68K	4822 111 90202
R 5126	RES.CHIP	MCR18	1%	6K8	4822 111 90544
R 5127	RES.CHIP	MCR18	1%	1K	4822 051 10102
R 5128	RES.CHIP	MCR18	1%	2K2	4822 111 90248
R 5129	RES.CHIP	RC-02H	1%	10K	5322 116 80428
R 5130	RES.MET.GLAZED	MCR18	1%	200E	5322 116 80599
R 5131	RES.NETWORK	MCR18	1%	390E	5322 111 91205
R 5132	RES.NETWORK	MCR18	1%	51E	5322 111 91352
R 5133	RES.CHIP	MCR18	1%	1K2	5322 111 90096
R 5134	RES.NETWORK	MCR18	1%	51E	5322 111 91352
R 5136	RES.CHIP	MCR18	1%	270E	4822 111 90154
R 5137	RES.CHIP	MCR18	1%	100K	4822 111 90214
R 5138	RES.CHIP	RC-02H	1%	10K	5322 116 80428
R 5139	RES.CHIP	MCR18	1%	6K8	4822 111 90544
R 5141	RES.CHIP	MCR18	1%	680E	4822 111 90162
R 5201	RES.CHIP	MCR18	1%	2K2	4822 111 90248
R 5202	RES.NETWORK	MCR18	1%	51E	5322 111 91352
R 5203	RES.NETWORK	MCR18	1%	51E	5322 111 91352
R 5204	RES.MET.GLAZED	MCR18	1%	6K2	5322 116 80608
R 5206	RES.CHIP	MCR18	1%	47E	4822 111 90217
R 5207	RES.CHIP	MCR18	1%	47E	4822 111 90217
R 5211	RES.CHIP	RC-02H	1%	10K	5322 116 80428
R 5212	RES.CHIP	MCR18	1%	68K	4822 111 90202
R 5213	RES.CHIP	MCR18	1%	1K	4822 051 10102
R 5214	RES.CHIP	RC-02H	1%	10K	5322 116 80428
R 5216	RES.CHIP	MCR18	1%	68K	4822 111 90202
R 5217	RES.CHIP	MCR18	1%	1K	4822 051 10102
R 5221	RES.CHIP	MCR18	1%	47E	4822 111 90217
R 5222	RES.CHIP	MCR18	1%	47E	4822 111 90217
R 5223	RES.CHIP	MCR18	1%	160E	4822 111 90345
R 5224	RES.CHIP	MCR18	1%	1K5	4822 051 10152
R 5226	RES.CHIP	MCR18	1%	3K3	4822 111 90157
R 5227	RES.NETWORK	MCR18	1%	100E	5322 111 91134
R 5228	RES.NETWORK	MCR18	1%	100E	5322 111 91134
R 5229	RES.CHIP	MCR18	1%	3K3	4822 111 90157
R 5231	RES.NETWORK	MCR18	1%	390E	5322 111 91205
R 5232	RES.CHIP	MCR18	1%	1K8	5322 111 90101
R 5234	RES.CHIP	MCR18	1%	47E	4822 111 90217
R 5236	RES.CHIP	MCR18	1%	3K3	4822 111 90157
R 5237	RES.CHIP	MCR18	1%	47E	4822 111 90217
R 5238	RES.CHIP	MCR18	1%	2K2	4822 111 90248
R 5239	RES.CHIP	MCR18	1%	160E	4822 111 90345
R 5241	RES.NETWORK	MCR18	1%	100E	5322 111 91134
R 5242	RES.NETWORK	MCR18	1%	100E	5322 111 91134
R 5243	RES.CHIP	MCR18	1%	3K3	4822 111 90157
R 5244	RES.NETWORK	MCR18	1%	390E	5322 111 91205
R 5246	RES.CHIP	MCR18	1%	2K7	4822 111 90569
R 5251	RES.CHIP	MCR18	1%	1K	4822 051 10102
R 5252	RES.CHIP	MCR18	1%	1K	4822 051 10102
R 5253	RES.CHIP	MCR18	1%	1K	4822 051 10102
R 5254	RES.CHIP	MCR18	1%	1K	4822 051 10102
R 5256	RES.CHIP	MCR18	1%	2K2	4822 111 90248
R 5257	RES.CHIP	MCR18	1%	2K2	4822 111 90248
R 5258	RES.CHIP	MCR18	1%	2K2	4822 111 90248
R 5263	RES.CHIP	MCR18	1%	820E	4822 111 90171
R 5264	RES.CHIP	MCR18	1%	47E	4822 111 90217
R 5266	RES.CHIP	MCR18	1%	47E	4822 111 90217
R 5271	RES.CHIP	MCR18	1%	1K	4822 051 10102
R 5272	RES.CHIP	MCR18	1%	3K3	4822 111 90157
R 5273	RES.CHIP	RC-02H	1%	10K	5322 116 80428
R 5301	RES.NETWORK	MCR18	1%	51E	5322 111 91352
R 5302	RES.NETWORK	MCR18	1%	51E	5322 111 91352
R 5303	RES.CHIP	MCR18	1%	10E	4822 051 10109
R 5304	RES.CHIP	MCR18	1%	10E	4822 051 10109
R 5306	RES.CHIP	RC-01	5%	1E	4822 111 90184
R 5307	RES.CHIP	RC-01	5%	1E	4822 111 90184
R 5308	RES.METAL FILM	MCR18	1%	360E	5322 116 80861
R 5309	RES.METAL FILM	MCR18	1%	360E	5322 116 80861
R 5311	RES.METAL FILM	MCR18	1%	360E	5322 116 80861
R 5312	RES.METAL FILM	MCR18	1%	360E	5322 116 80861
R 5313	RES.METAL FILM	MCR18	1%	360E	5322 116 80861
R 5314	RES.METAL FILM	MCR18	1%	360E	5322 116 80861
R 5316	RES.CHIP	RC-02H	1%	750E	4822 116 82384
R 5317	RES.CHIP	MCR18	1%	820E	4822 111 90171
R 5318	RES.NETWORK	MCR18	1%	100E	5322 111 91134
R 5319	RES.CHIP	MCR18	1%	18E	5322 111 90139
R 5321	RES.CHIP	MCR18	1%	20E	4822 111 90352
R 5322	RES.CHIP	MCR18	1%	20E	4822 111 90352
R 5323	RES.CHIP	MCR18	1%	20E	4822 111 90352
R 5351	RES.NETWORK	MCR18	1%	100E	5322 111 91134
R 5352	RES.NETWORK	MCR18	1%	100E	5322 111 91134
R 5353	RES.CHIP	MCR18	1%	10E	4822 051 10109
R 5354	RES.CHIP	MCR18	1%	10E	4822 051 10109
R 5356	RES.NETWORK	MCR18	1%	5K1	5322 111 91471
R 5357	RES.NETWORK	MCR18	1%	5K1	5322 111 91471

POSNR	DESCRIPTION				ORDERING CODE
R 5358	RES.CHIP	RC-02H	1%	10K	5322 116 80428
R 5359	RES.CHIP	RC-02H	1%	10K	5322 116 80428
R 5361	RES.CHIP	MCR18	1%	270E	4822 111 90154
R 5362	RES.CHIP	MCR18	1%	270E	4822 111 90154
R 5363	RES.CHIP	MCR18	1%	160E	4822 111 90345
R 5364	RES.CHIP	MCR18	1%	160E	4822 111 90345
R 5366	RES.NETWORK	MCR18	1%	51E	5322 111 91352
R 5367	RES.NETWORK	MCR18	1%	51E	5322 111 91352
R 5368	RES.NETWORK	MCR18	1%	51E	5322 111 91352
R 5369	RES.NETWORK	MCR18	1%	51E	5322 111 91352
R 5371	RES.NETWORK	MCR18	1%	51E	5322 111 91352
R 5372	RES.NETWORK	MCR18	1%	51E	5322 111 91352
R 5373	RES.NETWORK	MCR18	1%	51E	5322 111 91352
R 5374	RES.NETWORK	MCR18	1%	51E	5322 111 91352
R 5376	RES.CHIP	MCR18	1%	510E	4822 111 90245
R 5377	RES.CHIP	MCR18	1%	510E	4822 111 90245
R 5378	RES.NETWORK	MCR18	1%	100E	5322 111 91134
R 5379	RES.NETWORK	MCR18	1%	300E	5322 111 91469
R 5380	RES.CHIP	MCR18	1%	100K	4822 111 90214
R 5381	RES.NETWORK	MCR18	1%	300E	5322 111 91469
R 5382	RES.NETWORK	MCR18	1%	300E	5322 111 91469
R 5383	RES.NETWORK	MCR18	1%	300E	5322 111 91469
R 5384	RES.CHIP	MCR18	1%	330E	5322 111 90106
R 5385	RES.CHIP	MCR18	1%	100K	4822 111 90214
R 5386	RES.CHIP	MCR18	1%	330E	5322 111 90106
R 5387	RES.CHIP	MCR18	1%	330E	5322 111 90106
R 5388	RES.NETWORK	MCR18	1%	51E	5322 111 91352
R 5389	RES.NETWORK	MCR18	1%	51E	5322 111 91352
R 5401	RES.NETWORK	MCR18	1%	51E	5322 111 91352
R 5402	RES.NETWORK	MCR18	1%	51E	5322 111 91352
R 5403	RES.CHIP	MCR18	1%	10E	4822 051 10109
R 5404	RES.CHIP	MCR18	1%	10E	4822 051 10109
R 5406	RES.CHIP	RC-01	5%	1E	4822 111 90184
R 5407	RES.CHIP	RC-01	5%	1E	4822 111 90184
R 5408	RES.METAL FILM	MCR18	1%	360E	5322 116 80861
R 5409	RES.METAL FILM	MCR18	1%	360E	5322 116 80861
R 5411	RES.METAL FILM	MCR18	1%	360E	5322 116 80861
R 5412	RES.METAL FILM	MCR18	1%	360E	5322 116 80861
R 5413	RES.METAL FILM	MCR18	1%	360E	5322 116 80861
R 5414	RES.METAL FILM	MCR18	1%	360E	5322 116 80861
R 5416	RES.CHIP	RC-02H	1%	750E	4822 116 82384
R 5417	RES.CHIP	MCR18	1%	820E	4822 111 90171
R 5418	RES.NETWORK	MCR18	1%	100E	5322 111 91134
R 5419	RES.CHIP	MCR18	1%	18E	5322 111 90139
R 5421	RES.CHIP	MCR18	1%	20E	4822 111 90352
R 5422	RES.CHIP	MCR18	1%	20E	4822 111 90352
R 5423	RES.CHIP	MCR18	1%	20E	4822 111 90352
R 5451	RES.NETWORK	MCR18	1%	100E	5322 111 91134
R 5452	RES.NETWORK	MCR18	1%	100E	5322 111 91134
R 5453	RES.CHIP	MCR18	1%	10E	4822 051 10109
R 5454	RES.CHIP	MCR18	1%	10E	4822 051 10109
R 5456	RES.NETWORK	MCR18	1%	5K1	5322 111 91471
R 5457	RES.NETWORK	MCR18	1%	5K1	5322 111 91471
R 5458	RES.CHIP	RC-02H	1%	10K	5322 116 80428
R 5459	RES.CHIP	RC-02H	1%	10K	5322 116 80428
R 5461	RES.CHIP	MCR18	1%	270E	4822 111 90154
R 5462	RES.CHIP	MCR18	1%	270E	4822 111 90154
R 5463	RES.CHIP	MCR18	1%	160E	4822 111 90345
R 5464	RES.CHIP	MCR18	1%	160E	4822 111 90345
R 5466	RES.NETWORK	MCR18	1%	51E	5322 111 91352
R 5467	RES.NETWORK	MCR18	1%	51E	5322 111 91352
R 5468	RES.NETWORK	MCR18	1%	51E	5322 111 91352
R 5469	RES.NETWORK	MCR18	1%	51E	5322 111 91352
R 5471	RES.NETWORK	MCR18	1%	51E	5322 111 91352
R 5472	RES.NETWORK	MCR18	1%	51E	5322 111 91352
R 5473	RES.NETWORK	MCR18	1%	51E	5322 111 91352
R 5474	RES.NETWORK	MCR18	1%	51E	5322 111 91352
R 5476	RES.CHIP	MCR18	1%	510E	4822 111 90245
R 5477	RES.CHIP	MCR18	1%	510E	4822 111 90245
R 5478	RES.NETWORK	MCR18	1%	100E	5322 111 91134
R 5479	RES.NETWORK	MCR18	1%	300E	5322 111 91469
R 5480	RES.CHIP	MCR18	1%	100K	4822 111 90214
R 5481	RES.NETWORK	MCR18	1%	300E	5322 111 91469
R 5482	RES.NETWORK	MCR18	1%	300E	5322 111 91469
R 5483	RES.NETWORK	MCR18	1%	300E	5322 111 91469
R 5484	RES.CHIP	MCR18	1%	330E	5322 111 90106
R 5485	RES.CHIP	MCR18	1%	100K	4822 111 90214
R 5486	RES.CHIP	MCR18	1%	330E	5322 111 90106
R 5487	RES.CHIP	MCR18	1%	330E	5322 111 90106
R 5488	RES.NETWORK	MCR18	1%	51E	5322 111 91352
R 5489	RES.NETWORK	MCR18	1%	51E	5322 111 91352
R 5501	RES.NETWORK	MCR18	1%	100E	5322 111 91134
R 5502	RES.CHIP	MCR18	1%	43E	5322 111 91897
R 5503	RES.CHIP	MCR18	1%	43E	5322 111 91897
R 5504	RES.CHIP	MCR18	1%	4K7	5322 111 90111
R 5506	RES.CHIP	MCR18	1%	1K	4822 051 10102
R 5507	RES.CHIP	MCR18	1%	4K7	5322 111 90111
R 5508	RES.CHIP	MCR18	1%	470E	5322 111 90109
R 5509	RES.CHIP	MCR18	1%	470E	5322 111 90109
R 5511	RES.CHIP	MCR18	1%	1K	4822 051 10102
R 5512	RES.NETWORK	MCR18	1%	51E	5322 111 91352
R 5513	RES.NETWORK	MCR18	1%	51E	5322 111 91352
R 5514	RES.CHIP	RC-02H	1%	10K	5322 116 80428
R 5516	RES.CHIP	MCR18	1%	3K3	4822 111 90157
R 5517	RES.CHIP	MCR18	1%	820E	4822 111 90171
R 5518	RES.CHIP	MCR18	1%	820E	4822 111 90171
R 5519	RES.CHIP	MCR18	1%	510E	4822 111 90245
R 5521	RES.CHIP	MCR18	1%	220E	4822 111 90178
R 5522	RES.NETWORK	MCR18	1%	100E	5322 111 91134
R 5523	RES.CHIP	RC-02H	1%	10K	5322 116 80428
R 5524	RES.CHIP	RC-02H	1%	10K	5322 116 80428
R 5526	RES.CHIP	RC-02H	1%	10K	5322 116 80428
R 5527	POTM.TRIMMER	0.3W	25%	10K	4822 105 10455
R 5528	RES.CHIP	RC-02H	1%	10K	5322 116 80428
R 5529	RES.NETWORK	MCR18	1%	100E	5322 111 91134
R 5551	RES.NETWORK	MCR18	1%	100E	5322 111 91134
R 5552	RES.CHIP	MCR18	1%	43E	5322 111 91897
R 5553	RES.CHIP	MCR18	1%	43E	5322 111 91897
R 5554	RES.CHIP	MCR18	1%	4K7	5322 111 90111
R 5556	RES.CHIP	MCR18	1%	1K	4822 051 10102
R 5557	RES.CHIP	MCR18	1%	4K7	5322 111 90111
R 5558	RES.CHIP	MCR18	1%	470E	5322 111 90109
R 5559	RES.CHIP	MCR18	1%	470E	5322 111 90109
R 5561	RES.CHIP	MCR18	1%	1K	4822 051 10102
R 5562	RES.NETWORK	MCR18	1%	51E	5322 111 91352
R 5563	RES.NETWORK	MCR18	1%	51E	5322 111 91352
R 5564	RES.CHIP	RC-02H	1%	10K	5322 116 80428
R 5566	RES.CHIP	MCR18	1%	3K3	4822 111 90157
R 5567	RES.CHIP	MCR18	1%	820E	4822 111 90171
R 5568	RES.CHIP	MCR18	1%	820E	4822 111 90171
R 5569	RES.CHIP	MCR18	1%	510E	4822 111 90245
R 5571	RES.CHIP	MCR18	1%	220E	4822 111 90178
R 5572	RES.NETWORK	MCR18	1%	100E	5322 111 91134
R 5573	RES.CHIP	RC-02H	1%	10K	5322 116 80428
R 5574	RES.CHIP	RC-02H	1%	10K	5322 116 80428
R 5576	RES.CHIP	RC-02H	1%	10K	5322 116 80428
R 5577	POTM.TRIMMER	0.3W	25%	10K	4822 105 10455
R 5578	RES.CHIP	RC-02H	1%	10K	5322 116 80428
R 5579	RES.NETWORK	MCR18	1%	100E	5322 111 91134
R 5581	RES.CHIP	MCR18	1%	10E	4822 051 10109
R 5582	RES.CHIP	MCR18	1%	10E	4822 051 10109
R 5601	RES.NETWORK	MCR18	1%	5K1	5322 111 91471
R 5602	POTM.TRIMMER	0.3W	25%	10K	4822 105 10455
R 5603	RES.NETWORK	MCR18	1%	5K1	5322 111 91471
R 5604	POTM.TRIMMER	0.3W	25%	10K	4822 105 10455
R 5606	RES.CHIP	MCR18	1%	15K	4822 111 90196
R 5607	RES.CHIP	RC-02H	1%	10K	5322 116 80428
R 5608	POTM.TRIMMER	0.3W	25%	10K	4822 105 10455
R 5609	RES.CHIP	RC-02H	1%	10K	5322 116 80428
R 5611	RES.CHIP	MCR18	1%	1K	4822 051 10102
R 5612	RES.CHIP	MCR18	1%	1K	4822 051 10102
R 5613	RES.NETWORK	MCR18	1%	100E	5322 111 91134
R 5614	RES.NETWORK	MCR18	1%	100E	5322 111 91134
R 5616	RES.CHIP	MCR18	1%	6K8	4822 111 90544
R 5617	RES.CHIP	MCR18	1%	6K8	4822 111 90544
R 5618	RES.CHIP	MCR18	1%	27K	4822 111 90542
R 5619	RES.CHIP	MCR18	1%	27K	4822 111 90542
R 5621	RES.CHIP	MCR18	1%	1K2	5322 111 90096
R 5622	RES.CHIP	MCR18	1%	1K2	5322 111 90096
R 5623	RES.NETWORK	MCR18	1%	100E	5322 111 91134
R 5624	RES.NETWORK	MCR18	1%	100E	5322 111 91134
R 5626	RES.CHIP	MCR18	1%	1K	4822 051 10102
R 5627	RES.CHIP	MCR18	1%	1K	4822 051 10102
R 5628	RES.CHIP	MCR18	1%	15K	4822 111 90196
R 5629	RES.CHIP	MCR18	1%	15K	4822 111 90196
R 5631	RES.CHIP	MCR18	1%	27K	4822 111 90542
R 5632	RES.CHIP	MCR18	1%	27K	4822 111 90542
R 5633	RES.CHIP	MCR18	1%	15K	4822 111 90196
R 5634	RES.CHIP	MCR18	1%	15K	4822 111 90196
R 5636	RES.CHIP	MCR18	1%	1K	4822 051 10102
R 5637	RES.CHIP	MCR18	1%	1K	4822 051 10102
R 5638	RES.CHIP	MCR18	1%	2K2	4822 111 90248
R 5639	RES.CHIP	MCR18	1%	2K2	4822 111 90248
R 5641	RES.NETWORK	MCR18	1%	3K9	5322 111 91135
R 5642	RES.NETWORK	MCR18	1%	3K9	5322 111 91135
R 5651	RES.NETWORK	MCR18	1%	22K	5322 111 91349
R 5652	RES.CHIP	MCR18	1%	27K	4822 111 90542
R 5653	RES.CHIP	MCR18	1%	1K	4822 051 10102
R 5654	RES.CHIP	MCR18	1%	15K	4822 111 90196
R 5656	RES.CHIP	RC-02H	1%	10K	5322 116 80428
R 5657	RES.CHIP	RC-02H	1%	10K	5322 116 80428
R 5658	RES.CHIP	MCR18	1%	2K2	4822 111 90248
R 5659	RES.CHIP	RC-02H	1%	10K	5322 116 80428
R 5661	RES.CHIP	MCR18	1%	12K	4822 111 90253
R 5671	RES.CHIP	MCR18	1%	4K7	5322 111 90111
R 5672	RES.CHIP	MCR18	1%	4K7	5322 111 90111
R 5673	RES.CHIP	MCR18	1%	68K	4822 111 90202
R 5674	RES.CHIP	MCR18	1%	68K	4822 111 90202
R 5676	RES.CHIP	RC-02H	1%	10K	5322 116 80428
R 5677	RES.CHIP	RC-02H	1%	10K	5322 116 80428
R 5678	RES.CHIP	RC-02H	1%	10K	5322 116 80428
R 5679	RES.CHIP	RC-02H	1%	10K	5322 116 80428
R 5681	RES.CHIP	MCR18	1%	3K3	4822 111 90157
R 5682	RES.CHIP	MCR18	1%	3K3	4822 111 90157
R 5683	RES.CHIP	RC-02H	1%	10K	5322 116 80428
R 5684	RES.CHIP	RC-02H	1%	10K	5322 116 80428
R 5691	RES.CHIP	MCR18	1%	10E	4822 051 10109
R 5692	RES.CHIP	MCR18	1%	10E	4822 051 10109
R 5693	RES.CHIP	MCR18	1%	10E	4822 051 10109
R 5707	RES.CHIP	RC-02H	1%	10K	5322 116 80428
R 5708	POTM.TRIMMER	0.3W	25%	10K	4822 105 10455
R 5709	RES.CHIP	RC-02H	1%	10K	5322 116 80428
R 5711	RES.CHIP	MCR18	1%	1K	4822 051 10102
R 5712	RES.CHIP	MCR18	1%	1K	4822 051 10102
R 5713	RES.NETWORK	MCR18	1%	100E	5322 111 91134
R 5714	RES.NETWORK	MCR18	1%	100E	5322 111 91134
R 5716	RES.CHIP	MCR18	1%	6K8	4822 111 90544
R 5717	RES.CHIP	MCR18	1%	6K8	4822 111 90544
R 5718	RES.CHIP	MCR18	1%	27K	4822 111 90542
R 5719	RES.CHIP	MCR18	1%	27K	4822 111 90542
R 5721	RES.CHIP	MCR18	1%	1K2	5322 111 90096
R 5722	RES.CHIP	MCR18	1%	1K2	5322 111 90096
R 5723	RES.NETWORK	MCR18	1%	100E	5322 111 91134
R 5724	RES.NETWORK	MCR18	1%	100E	5322 111 91134
R 5726	RES.CHIP	MCR18	1%	1K	4822 051 10102
R 5727	RES.CHIP	MCR18	1%	1K	4822 051 10102
R 5728	RES.CHIP	MCR18	1%	15K	4822 111 90196
R 5729	RES.CHIP	MCR18	1%	15K	4822 111 90196
R 5731	RES.CHIP	MCR18	1%	27K	4822 111 90542
R 5732	RES.CHIP	MCR18	1%	27K	4822 111 90542
R 5733	RES.CHIP	MCR18	1%	15K	4822 111 90196
R 5734	RES.CHIP	MCR18	1%	15K	4822 111 90196
R 5736	RES.CHIP	MCR18	1%	1K	4822 051 10102
R 5737	RES.CHIP	MCR18	1%	1K	4822 051 10102
R 5738	RES.CHIP	MCR18	1%	2K2	4822 111 90248
R 5739	RES.CHIP	MCR18	1%	2K2	4822 111 90248
R 5741	RES.NETWORK	MCR18	1%	3K9	5322 111 91135
R 5742	RES.NETWORK	MCR18	1%	3K9	5322 111 91135
R 5751	RES.NETWORK	MCR18	1%	22K	5322 111 91349
R 5752	RES.CHIP	MCR18	1%	27K	4822 111 90542
R 5753	RES.CHIP	MCR18	1%	1K	4822 051 10102
R 5754	RES.CHIP	MCR18	1%	15K	4822 111 90196

POSNR	DESCRIPTION		ORDERING CODE
R 5756	RES.CHIP	RC-02H 1% 10K	5322 116 80428
R 5757	RES.CHIP	RC-02H 1% 10K	5322 116 80428
R 5758	RES.CHIP	MCR18 1% 2K2	4822 111 90248
R 5759	RES.CHIP	RC-02H 1% 10K	5322 116 80428
R 5761	RES.CHIP	MCR18 1% 12K	4822 111 90253
R 5771	RES.CHIP	MCR18 1% 4K7	5322 111 90111
R 5772	RES.CHIP	MCR18 1% 4K7	5322 111 90111
R 5773	RES.CHIP	MCR18 1% 68K	4822 111 90202
R 5774	RES.CHIP	MCR18 1% 68K	4822 111 90202
R 5776	RES.CHIP	RC-02H 1% 10K	5322 116 80428
R 5777	RES.CHIP	RC-02H 1% 10K	5322 116 80428
R 5778	RES.CHIP	RC-02H 1% 10K	5322 116 80428
R 5779	RES.CHIP	RC-02H 1% 10K	5322 116 80428
R 5781	RES.CHIP	MCR18 1% 3K3	4822 111 90157
R 5782	RES.CHIP	MCR18 1% 3K3	4822 111 90157
R 5783	RES.CHIP	RC-02H 1% 10K	5322 116 80428
R 5784	RES.CHIP	RC-02H 1% 10K	5322 116 80428
R 5791	RES.CHIP	MCR18 1% 10E	4822 051 10109
R 5792	RES.CHIP	MCR18 1% 10E	4822 051 10109
R 5793	RES.CHIP	MCR18 1% 10E	4822 051 10109
R 5801	RES.CHIP	MCR18 1% 3K3	4822 111 90157
R 5802	POTM.SLIDE	0.3W 25% 2K2	5322 105 20033
R 5804	RES.MET.GLAZED	MCR18 1% 4K3	5322 116 80605
R 5805	RES.MET.GLAZED	MCR18 1% 4K3	5322 116 80605
R 5806	RES.MET.GLAZED	MCR18 1% 4K3	5322 116 80605
R 5809	RES.MET.GLAZED	MCR18 1% 4K3	5322 116 80605
R 5811	RES.MET.GLAZED	MCR18 1% 4K3	5322 116 80605
R 5814	RES.MET.GLAZED	MCR18 1% 4K3	5322 116 80605
R 5815	RES.MET.GLAZED	MCR18 1% 4K3	5322 116 80605
R 5816	RES.CHIP	MCR18 1% 3K3	4822 111 90157
R 5817	POTM.SLIDE	0.3W 25% 2K2	5322 105 20033
R 5819	RES.MET.GLAZED	MCR18 1% 4K3	5322 116 80605
R 5821	RES.MET.GLAZED	MCR18 1% 4K3	5322 116 80605
R 5822	RES.MET.GLAZED	MCR18 1% 4K3	5322 116 80605
R 5824	RES.NETWORK	MCR18 1% 5K1	5322 111 91471
R 5825	RES.NETWORK	MCR18 1% 5K1	5322 111 91471
R 5826	RES.NETWORK	MCR18 1% 3K	5322 111 91351
R 5828	POTM.TRIMMER	0.3W 25% 10K	4822 105 10455
R 5829	POTM.TRIMMER	0.3W 25% 10K	4822 105 10455
R 5830	POTM.SLIDE	0.3W 25% 4K7	5322 105 20034
R 5831	RES.CHIP	RC-02H 1% 750E	4822 116 82384
R 5832	POTM.SLIDE	0.3W 25% 4K7	5322 105 20034
R 5833	RES.CHIP	MCR18 1% 15K	4822 111 90196
R 5834	RES.NETWORK	MCR18 1% 5K1	5322 111 91471
R 5835	RES.NETWORK	MCR18 1% 5K1	5322 111 91471
R 5836	RES.NETWORK	MCR18 1% 5K1	5322 111 91471
R 5838	POTM.TRIMMER	0.3W 25% 10K	4822 105 10455
R 5839	POTM.TRIMMER	0.3W 25% 10K	4822 105 10455
R 5840	POTM.SLIDE	0.3W 25% 4K7	5322 105 20034
R 5841	RES.CHIP	RC-02H 1% 750E	4822 116 82384
R 5842	POTM.SLIDE	0.3W 25% 4K7	5322 105 20034
R 5844	RES.NETWORK	MCR18 1% 5K1	5322 111 91471
R 5845	RES.NETWORK	MCR18 1% 5K1	5322 111 91471
R 5846	RES.NETWORK	MCR18 1% 3K	5322 111 91351
R 5853	RES.CHIP	MCR18 1% 15K	4822 111 90196
R 5854	RES.NETWORK	MCR18 1% 5K1	5322 111 91471
R 5855	RES.NETWORK	MCR18 1% 5K1	5322 111 91471
R 5856	RES.NETWORK	MCR18 1% 5K1	5322 111 91471
R 5858	RES.CHIP	MCR18 1% 4K7	5322 111 90111
R 5903	RES.CHIP	MCR18 1% 160E	4822 111 90345
R 5904	RES.CHIP	MCR18 1% 820E	4822 111 90171
R 5907	RES.CHIP	MCR18 1% 120E	4822 111 90339
R 5908	RES.CHIP	MCR18 1% 75E	4822 111 90371
R 5909	RES.CHIP	RC-01 5% 1E	4822 111 90184
R 5911	RES.CHIP	RC-01 5% 1E	4822 111 90184
R 5912	RES.NETWORK	MCR18 1% 5K1	5322 111 91471
R 5913	RES.CHIP	MCR18 1% 15K	4822 111 90196
R 5914	RES.CHIP	RC-01 5% 5E6	4822 111 90394
R 5916	RES.CHIP	RC-01 5% 5E6	4822 111 90394
R 5917	RES.CHIP	RC-02H 1% 10K	5322 116 80428
R 5918	RES.CHIP	MCR18 1% 15K	4822 111 90196
R 5919	RES.CHIP	RC-02H 1% 10K	5322 116 80428
R 5921	RES.CHIP	MCR18 1% 15K	4822 111 90196
R 5922	RES.CHIP	MCR18 1% 1K	4822 051 10102
R 5923	RES.CHIP	MCR18 1% 1K	4822 051 10102
R 5924	RES.CHIP	RC-01 5% 5E6	4822 111 90394
R 5926	RES.CHIP	RC-01 5% 5E6	4822 111 90394
R 5927	RES.NETWORK	MCR18 1% 22K	5322 111 91349
R 5928	RES.CHIP	MCR18 1% 4K7	5322 111 90111
R 5929	RES.CHIP	MCR18 1% 510E	4822 111 90245
R 5930	RES.CHIP	MCR18 1% 2K2	4822 111 90248
R 5931	RES.CHIP	MCR18 1% 560E	5322 111 90113
R 5932	RES.CHIP	RC-01 5% 1E	4822 111 90184
R 5933	RES.CHIP	RC-01 5% 1E	4822 111 90184
R 5935	RES.MET.GLAZED	MCR18 1% 200E	5322 116 80599
R 6001	RES.N.T.C.	1.7A 20% 82E	4822 116 30069
R 6002	RES.METAL FILM	MRS25 1% 383K	5322 116 53576
R 6003	RES.METAL FILM	MRS25 1% 383K	5322 116 53576
R 6004	RES.METAL FILM	MRS25 1% 316E	5322 116 53499
R 6005	RES.METAL FILM	MRS25 1% 464E	5322 116 53232
R 6006	RES.METAL FILM	MRS25 1% 10K	4822 116 53022
R 6007	RES.METAL FILM	MRS25 1% 10K	4822 116 53022
R 6008	RES.METAL FILM	MRS25 1% 316E	5322 116 53499
R 6009	RES.N.T.C.	0.5W 10% 1K5	4822 116 30248
R 6010	RES.METAL FILM	MRS25 1% 14K7	4822 116 53531
R 6011	RES.METAL FILM	MRS25 1% 237E	5322 116 53259
R 6012	RES.METAL FILM	MRS25 1% 178E	5322 116 53572
R 6013	RES.METAL FILM	MRS25 1% 100E	5322 116 53126
R 6014	RES.METAL FILM	MRS25 1% 3E16	4822 116 52993
R 6016	RES.METAL FILM	MRS25 1% 10K	4822 116 53022
R 6017	RES.METAL FILM	MRS25 1% 1E	4822 050 21008
R 6018	RES.METAL FILM	MRS25 1% 1E	4822 050 21008
R 6019	RES.METAL FILM	MRS25 1% 10K	4822 116 53022
R 6020	RES.METAL FILM	MRS25 1% 21E5	5322 116 53426
R 6021	RES.METAL FILM	MRS25 1% 10K	4822 116 53022
R 6022	RES.METAL FILM	MRS25 1% 10K	4822 116 53022
R 6031	RES.METAL FILM	MRS25 1% 383E	5322 116 53332
R 6032	RES.METAL FILM	1/4W .25% 5K62	5322 116 80473
R 6033	RES.METAL FILM	1/4W .25% 7K5	5322 116 80474
R 6034	RES.METAL FILM	MRS25 1% 6K19	5322 116 53263
R 6036	RES.METAL FILM	MRS25 1% 7K5	4822 116 53028
R 6037	RES.METAL FILM	MRS25 1% 31K6	5322 116 53262

POSNR	DESCRIPTION		ORDERING CODE
R 6038	RES.METAL FILM	MRS25 1% 100E	5322 116 53126
R 6039	RES.METAL FILM	MRS25 1% 10E	4822 116 52891
R 6041	RES.METAL FILM	MRS25 1% 3K83	4822 116 53079
R 6042	RES.METAL FILM	MRS25 1% 3K83	4822 116 53079
R 6043	RES.METAL FILM	MRS25 1% 100K	4822 050 21004
R 6044	RES.METAL FILM	MRS25 1% 100K	4822 050 21004
R 6101	RES.METAL FILM	MRS25 1% 100E	5322 116 53126
R 6102	RES.METAL FILM	MRS25 1% 100E	5322 116 53126
R 6103	RES.METAL FILM	MRS25 1% 1K	4822 116 53108
R 6131	RES.METAL FILM	MRS25 1% 10E	4822 116 52891
R 6132	RES.METAL FILM	MRS25 1% 100K	4822 050 21004
R 6133	RES.METAL FILM	MRS25 1% 100K	4822 050 21004
R 6134	RES.METAL FILM	MRS25 1% 1K	4822 116 53108
R 6136	RES.METAL FILM	MRS25 1% 4K64	5322 116 53213
R 6137	RES.METAL FILM	MRS25 1% 316E	5322 116 53499
R 6138	RES.METAL FILM	MRS25 1% 1K	4822 116 53108
R 6139	RES.METAL FILM	MRS25 1% 100E	5322 116 53126
R 6201	RES.METAL FILM	1/4W .25% 160K	5322 116 53412
R 6202	RES.HI-TENSION	VR37 1% 31M6	5322 116 64103
R 6203	RES.METAL FILM	MRS25 1% 100K	4822 050 21004
R 6204	RES.METAL FILM	MRS25 1% 10K	4822 116 53022
R 6205	RES.METAL FILM	MRS25 1% 1K	4822 116 53108
R 6206	RES.METAL FILM	MRS25 1% 16K2	5322 116 53589
R 6207	RES.METAL FILM	MRS25 1% 51E1	5322 116 53213
R 6208	RES.METAL FILM	MRS25 1% 464E	5322 116 53232
R 6209	RES.METAL FILM	MRS25 1% 4K64	5322 116 53213
R 6211	RES.METAL FILM	MRS25 1% 46K4	5322 116 53314
R 6212	RES.METAL FILM	MRS25 1% 4K64	5322 116 53213
R 6213	RES.METAL FILM	MRS25 1% 215E	5322 116 53325
R 6214	RES.HI-TENSION	VR25 5% 10M	4822 110 72214
R 6216	RES.METAL FILM	MRS25 1% 100E	5322 116 53126
R 6217	RES.METAL FILM	MRS25 1% 1E	4822 050 21008
R 6300	RES.METAL FILM	MRS25 1% 2K61	5322 116 53327
R 6301	RES.METAL FILM	MRS25 1% 464E	5322 116 53232
R 6302	RES.METAL FILM	MRS25 1% 909E	4822 116 53533
R 6303	RES.METAL FILM	MRS25 1% 3K83	4822 116 53079
R 6304	RES.METAL FILM	MRS25 1% 6K81	5322 116 53252
R 6311	RES.METAL FILM	MRS25 1% 750E	5322 116 53265
R 6312	RES.METAL FILM	MRS25 1% 4K22	5322 116 53246
R 6313	RES.METAL FILM	MRS25 1% 825E	5322 116 53541
R 6401	RES.METAL FILM	MRS25 1% 1K78	5322 116 53208
R 6402	RES.METAL FILM	MRS25 1% 178K	5322 116 53555
R 6403	RES.METAL FILM	MRS25 1% 215E	5322 116 53325
R 6404	RES.METAL FILM	MRS25 1% 7K5	4822 116 53028
R 6406	RES.METAL FILM	MRS25 1% 26K1	5322 116 53261
R 6407	RES.METAL FILM	MRS25 1% 4K22	5322 116 53246
R 6408	POTM.TRIMMER	OMP10 20% 10K	5322 100 10113
R 6500	RES.METAL FILM	MRS25 1% 10E	4822 116 52891
R 6501	RES.METAL FILM	MRS25 1% 511E	5322 116 53135
R 6502	RES.METAL FILM	MRS25 1% 100K	4822 050 21004
R 6503	RES.METAL FILM	MRS25 1% 5K11	5322 116 53494
R 6504	RES.METAL FILM	MRS25 1% 19K6	5322 116 53258
R 6506	RES.METAL FILM	MRS25 1% 5K62	5322 116 53495
R 6507	RES.METAL FILM	MRS25 1% 511E	5322 116 53135
R 6508	RES.METAL FILM	1/4W .25% 3K67	5322 116 53411
R 6509	RES.METAL FILM	1/4W .25% 500E	5322 116 53408
R 6511	RES.METAL FILM	MRS25 1% 562E	5322 116 53656
R 7001	RES.METAL FILM	MRS25 1% 1K	4822 116 53108
R 7002	RES.METAL FILM	MRS25 1% 1K	4822 116 53108
R 7003	RES.METAL FILM	MRS25 1% 75K	5322 116 53266
R 7004	RES.METAL FILM	MRS25 1% 5K11	5322 116 53494
R 7005	POTM.CARB.TRACK	CRC17 20% 10K	5322 101 30546
R 7006	POTM.CARB.TRACK	CRC17 20% 10K	5322 101 30546
R 7007	POTM.CARB.TRACK	CRC17 20% 10K	5322 101 30546
R 7008	POTM.CARB.TRACK	CRC17 20% 10K	5322 101 30546
R 7009	POTM.CARB.TRACK	CRC17 20% 10K	5322 101 30546
R 7010	POTM.CARB.TRACK	CRC17 20% 10K	5322 101 30546
R 7011	POTM.CARB.TRACK	CRC17 20% 10K	5322 101 30546
R 7012	POTM.CARB.TRACK	CRC17 20% 10K	5322 101 30546
R 7013	RES.METAL FILM	MRS25 1% 100E	5322 116 53126
R 7014	RES.METAL FILM	MRS25 1% 162E	5322 116 53523
R 7016	RES.N.T.C.	0.5W 10% 2K2	4822 116 30254
R 7017	RES.METAL FILM	MRS25 1% 1K1	5322 116 53473
R 7018	RES.METAL FILM	MRS25 1% 1M	4822 116 52843
R 7019	RES.METAL FILM	MRS25 1% 100E	5322 116 53126
R 7102	RES.METAL FILM	MRS25 1% 100E	5322 116 53126
R 7103	RES.METAL FILM	MRS25 1% 5E11	4822 116 52999
R 8001	RES.CHIP	RC-02H 1% 10K	5322 116 80428
U 3262	RES.HI-TENSION	VR25 5% 7M5	5322 116 60131

25.4.3 COILS

POSNR	DESCRIPTION		ORDERING CODE
L 0201	COIL	15UH	5322 157 52539
L 0301	COIL	82UH	4822 158 10563
L 0401	COIL	82UH	4822 158 10563
L 0501	COIL	82UH	4822 158 10563
L 0502	COIL	82UH	4822 158 10563
L 0503	COIL	82UH	4822 158 10563
L 0504	COIL	82UH	4822 158 10563
L 0801	COIL	0.39UH 10%	5322 157 53334
L 0806	COIL	0.39UH 10%	5322 157 53334
L 0814	COIL	0.15UH 10%	5322 157 62206
L 0816	COIL	COIL	5322 157 53335
L 0822	COIL	COIL	5322 157 53335
L 0827	COIL	0.15UH 10%	5322 157 62206
L 0831	COIL	0.39UH 10%	5322 157 53334
L 0836	COIL	0.39UH 10%	5322 157 53334
L 0844	COIL	0.15UH 10%	5322 157 62206
L 0846	COIL	COIL	5322 157 53335
L 0852	COIL	COIL	5322 157 53335
L 0857	COIL	0.15UH 10%	5322 157 62206
L 0865	COIL	0.15UH 10%	5322 157 53333
L 0881	COIL	82UH	4822 158 10563
L 1001	COIL	0.22UH 10%	5322 157 62208

POSNR	DESCRIPTION		ORDERING CODE
L 1101	COIL	0.22UH 10%	5322 157 62208
L 1401	COIL	1500UH	4822 156 21293
L 1402	COIL	1500UH	4822 156 21293
L 1403	COIL	1500UH	4822 156 21293
L 1421	COIL	1500UH	4822 156 21293
L 1422	COIL	1500UH	4822 156 21293
L 1423	COIL	1500UH	4822 156 21293
L 3001	COIL	2.2UH 10%	5322 157 62209
L 3002	COIL	2.2UH 10%	5322 157 62209
L 3003	COIL	2.7UH 10%	5322 157 62211
L 4101	COIL	2.0UH	4822 157 51757
L 4801	COIL	0.01H	5322 157 53019
L 5101	COIL	0.22UH 10%	5322 157 62208
L 5111	COIL	0.18UH 10%	5322 157 62207
L 5121	COIL	1008CS 39NH	5322 157 62212
L 5301	COIL	0.15UH 10%	5322 157 62206
L 5302	COIL	0.15UH 10%	5322 157 62206
L 5303	COIL	0.15UH 10%	5322 157 62206
L 5353	COIL	0.15UH 10%	5322 157 62206
L 5401	COIL	0.15UH 10%	5322 157 62206
L 5402	COIL	0.15UH 10%	5322 157 62206
L 5403	COIL	0.15UH 10%	5322 157 62206
L 5453	COIL	0.15UH 10%	5322 157 62206
L 5901	COIL	82UH	4822 158 10563
L 5902	COIL	82UH	4822 158 10563
L 5903	COIL	COIL ASSY	5322 157 53597
L 6000	COIL	100UH	5322 157 52363
L 6001	COIL	100UH	5322 157 52363
L 6002	COIL	100UH	5322 157 52363
L 6003	COIL	5.6UH	4822 157 52259
L 6004	COIL	220UH	5322 157 53524
L 6006	COIL	220UH	5322 157 53524
L 6101	COIL	10UH	5322 157 52513
L 6102	COIL	47UH	4822 152 10106
L 6103	COIL	100UH	5322 157 52363
L 6104	COIL	100UH	5322 157 52363
L 6106	COIL	82UH	4822 158 10563
L 6107	COIL	82UH	4822 158 10563
L 6108	COIL	82UH	4822 158 10563
L 6109	COIL	82UH	4822 158 10563
L 6111	COIL	15UH	5322 157 52539
L 6201	COIL	82UH	4822 158 10563
L 6501	COIL	82UH	4822 158 10563
L 7101	COIL	15UH	5322 157 52539

25.4.4 SEMI-CONDUCTORS

POSNR	DESCRIPTION		ORDERING CODE
V 0200	TRANSISTOR	BC548C	4822 130 44196
V 0201	DIODE	BAW62	4822 130 30613
V 0202	DIODE	BAW62	4822 130 30613
V 0203	TRANSISTOR	BC548C	4822 130 44196
V 0204	TRANSISTOR	BC548C	4822 130 44196
V 0206	DIODE	BAW62	4822 130 30613
V 0207	TRANSISTOR	BC548C	4822 130 44196
V 0208	TRANSISTOR	BC548C	4822 130 44196
V 0213	DIODE	BAW62	4822 130 30613
V 0214	DIODE	BAW62	4822 130 30613
V 0301	DIODE	BAT85	4822 130 31983
V 0302	DIODE	BAT85	4822 130 31983
V 0501	DIODE,REFERENCE	BZX79-C3V6	5322 130 34834
V 0502	DIODE	BAW62	4822 130 30613
V 0503	DIODE	BAT85	4822 130 31983
V 0504	DIODE	BAW62	4822 130 30613
V 0506	DIODE	BAT85	4822 130 31983
V 0512	INTEGR.CIRCUIT	LM336Z-2.5	5322 209 81329
V 0521	TRANSISTOR	BC548C	4822 130 44196
V 0522	TRANSISTOR	BC548C	4822 130 44196
V 0523	DIODE,REFERENCE	BZX79-C5V1	4822 130 34233
V 0531	TRANSISTOR	BC548C	4822 130 44196
V 0532	TRANSISTOR	BC548C	4822 130 44196
V 0551	TRANSISTOR	BC558B	4822 130 44197
V 0552	TRANSISTOR	BC558B	4822 130 44197
V 0553	DIODE	BAW62	4822 130 30613
V 0554	DIODE	BAW62	4822 130 30613
V 0555	DIODE,REFERENCE	BZX79-C11	4822 130 34488
V 0556	DIODE	BAW62	4822 130 30613
V 0557	DIODE	BAW62	4822 130 30613
V 0558	TRANSISTOR	BC548C	4822 130 44196
V 0566	DIODE,REFERENCE	BZX79-C5V1	4822 130 34233
V 0567	TRANSISTOR	BF370	4822 130 42589
V 0568	TRANSISTOR	BC548C	4822 130 44196
V 0569	TRANSISTOR	BC558B	4822 130 44197
V 0591	DIODE,REFERENCE	BZX79-C5V1	4822 130 34233
V 0592	DIODE	BAW62	4822 130 30613
V 0593	TRANSISTOR	BC548C	4822 130 44196
V 0601	TRANSISTOR	BC548C	4822 130 44196
V 0602	TRANSISTOR	BC558B	4822 130 44197
V 0603	DIODE	BZV86-C1V4	4822 130 81423
V 0604	TRANSISTOR	BC558B	4822 130 44197
V 0606	TRANSISTOR	BC548C	4822 130 44196
V 0607	DIODE,REFERENCE	BZX79-C6V2	4822 130 34167
V 0608	TRANSISTOR	BC548C	4822 130 44196
V 0609	DIODE	BAW62	4822 130 30613
V 0611	DIODE	BAW62	4822 130 30613
V 0611	TRANSISTOR	BC548C	4822 130 44196
V 0612	DIODE	BAW62	4822 130 30613
V 0612	TRANSISTOR	BC558B	4822 130 44197
V 0613	DIODE	BAW62	4822 130 30613
V 0614	DIODE	BAW62	4822 130 30613
V 0614	DIODE,REFERENCE	BZX79-B27	4822 130 34379
V 0615	DIODE	BAW62	4822 130 30613
V 0616	TRANSISTOR	BC548C	4822 130 44196
V 0616	DIODE	BAW62	4822 130 30613

POSNR	DESCRIPTION		ORDERING CODE
V 0617	TRANSISTOR	BC548C	4822 130 44196
V 0618	DIODE	BAW62	4822 130 30613
V 0619	DIODE	BAW62	4822 130 30613
V 0621	TRANSISTOR	BC548C	4822 130 44196
V 0622	TRANSISTOR	BC548C	4822 130 44196
V 0623	DIODE	BAW62	4822 130 30613
V 0624	DIODE	BAW62	4822 130 30613
V 0626	TRANSISTOR	BC548C	4822 130 44196
V 0627	TRANSISTOR	BC548C	4822 130 44196
V 0628	TRANSISTOR	BC548C	4822 130 44196
V 0629	TRANSISTOR	BC548C	4822 130 44196
V 0630	TRANSISTOR	BC548C	4822 130 44196
V 0631	TRANSISTOR	BC548C	4822 130 44196
V 0632	TRANSISTOR	BC548C	4822 130 44196
V 0633	TRANSISTOR	BC548C	4822 130 44196
V 0634	DIODE	BAW62	4822 130 30613
V 0636	DIODE	BAW62	4822 130 30613
V 0701	TRANSISTOR,CHIP	BCW33	5322 130 44337
V 0702	TRANSISTOR,CHIP	BCW33	5322 130 44337
V 0703	TRANSISTOR,CHIP	BFR92R	5322 130 44606
V 0704	TRANSISTOR,CHIP	BFR92	5322 130 42145
V 0706	TRANSISTOR,CHIP	BCW30	5322 130 44335
V 0707	DIODE,CHIP	BAW56	5322 130 30691
V 0708	DIODE,CHIP	BAW56	5322 130 30691
V 0721	TRANSISTOR,CHIP	BCW33	5322 130 44337
V 0730	TRANSISTOR,CHIP	BF550	4822 130 42131
V 0731	TRANSISTOR,CHIP	BCW30	5322 130 44335
V 0732	TRANSISTOR,CHIP	BF550	4822 130 42131
V 0733	TRANSISTOR,CHIP	BF550	4822 130 42131
V 0734	TRANSISTOR,CHIP	BCW33	5322 130 44337
V 0736	TRANSISTOR,CHIP	BCW33	5322 130 44337
V 0760	TRANSISTOR,CHIP	BF550	4822 130 42131
V 0761	TRANSISTOR,CHIP	BCW30	5322 130 44335
V 0762	TRANSISTOR,CHIP	BF550	4822 130 42131
V 0763	TRANSISTOR,CHIP	BF550	4822 130 42131
V 0764	TRANSISTOR,CHIP	BCW33	5322 130 44337
V 0766	TRANSISTOR,CHIP	BCW33	5322 130 44337
V 0801	TRANSISTOR	BFR96S/02	5322 130 42244
V 0806	TRANSISTOR	BFR96S/02	5322 130 42244
V 0814	TRANSISTOR	BC337	4822 130 40855
V 0816	TRANSISTOR	BFR96S/02	5322 130 42244
V 0822	TRANSISTOR	BFR96S/02	5322 130 42244
V 0827	TRANSISTOR	BC337	4822 130 40855
V 0831	TRANSISTOR	BFR96S/02	5322 130 42244
V 0836	TRANSISTOR	BFR96S/02	5322 130 42244
V 0844	TRANSISTOR	BC337	4822 130 40855
V 0846	TRANSISTOR	BFR96S/02	5322 130 42244
V 0852	TRANSISTOR	BFR96S/02	5322 130 42244
V 0857	TRANSISTOR	BC337	4822 130 40855
V 0862	TRANSISTOR	BC558B	4822 130 44197
V 0863	DIODE	BZV86-C1V4	4822 130 81423
V 0864	DIODE	BZV86-C2V0	4822 130 81424
V 0865	DIODE	BAW62	4822 130 30613
V 0866	DIODE	BAW62	4822 130 30613
V 0867	TRANSISTOR	BFQ22S	5322 130 42031
V 0871	TRANSISTOR	BC548C	4822 130 44196
V 0872	DIODE,REFERENCE	BZX79-C3V0	4822 130 31881
V 0903	TRANSISTOR,FET	BFQ13	5322 130 44404
V 0908	TRANSISTOR,FET	BFQ13	5322 130 44404
V 0913	TRANSISTOR,FET	BFQ13	5322 130 44404
V 0918	TRANSISTOR,FET	BFQ13	5322 130 44404
V 0921	DIODE,REFERENCE	BZV11	5322 130 34294
V 0978	DIODE,REFERENCE	BZX79-C5V1	4822 130 34233
V 0981	DIODE,REFERENCE	BZX79-B27	4822 130 34379
V 0986	TRANSISTOR	BC548C	4822 130 44196
V 0992	DIODE	BZV86-C2V0	4822 130 81424
V 1000	DIODE	BA483	4822 130 32656
V 1001	TRANSISTOR	BF324	4822 130 41448
V 1002	TRANSISTOR	BF324	4822 130 41448
V 1003	REPAIR SET	SET ON 4401	5322 310 10325
V 1004	DIODE	BA483	4822 130 32656
V 1005	DIODE	BA483	4822 130 32656
V 1006	REPAIR SET	SET ON 4401	5322 310 10325
V 1007	DIODE	BA483	4822 130 32656
V 1008	DIODE	BA483	4822 130 32656
V 1009	DIODE	BA483	4822 130 32656
V 1010	DIODE,REFERENCE	BZX79-C10	4822 130 34297
V 1011	REPAIR SET	SET ON 4401	5322 310 10325
V 1012	DIODE	BA483	4822 130 32656
V 1013	DIODE	BA483	4822 130 32656
V 1014	DIODE	BA483	4822 130 32656
V 1016	TRANSISTOR	ON4401	5322 130 61498
V 1017	DIODE	BA483	4822 130 32656
V 1019	TRANSISTOR	BF199	4822 130 44154
V 1021	TRANSISTOR	BF199	4822 130 44154
V 1022	TRANSISTOR	BF324	4822 130 41448
V 1023	DIODE,REFERENCE	BZX79-C5V6	4822 130 34173
V 1024	TRANSISTOR	BF370	4822 130 42589
V 1061	DIODE	BAW62	4822 130 30613
V 1062	DIODE	BAW62	4822 130 30613
V 1063	TRANSISTOR	BF324	4822 130 41448
V 1064	TRANSISTOR	BF324	4822 130 41448
V 1100	DIODE	BA483	4822 130 32656
V 1101	TRANSISTOR	BF324	4822 130 41448
V 1102	TRANSISTOR	BF324	4822 130 41448
V 1103	REPAIR SET	SET ON 4401	5322 310 10325
V 1104	DIODE	BA483	4822 130 32656
V 1105	DIODE	BA483	4822 130 32656
V 1106	REPAIR SET	SET ON 4401	5322 310 10325
V 1107	DIODE	BA483	4822 130 32656
V 1108	DIODE	BA483	4822 130 32656
V 1109	DIODE	BA483	4822 130 32656
V 1110	DIODE,REFERENCE	BZX79-C10	4822 130 34297
V 1111	REPAIR SET	SET ON 4401	5322 310 10325
V 1112	DIODE	BA483	4822 130 32656
V 1113	DIODE	BA483	4822 130 32656
V 1114	DIODE	BA483	4822 130 32656
V 1116	TRANSISTOR	ON4401	5322 130 61498
V 1117	DIODE	BA483	4822 130 32656
V 1119	TRANSISTOR	BF199	4822 130 44154
V 1121	TRANSISTOR	BF199	4822 130 44154

POSNR	DESCRIPTION		ORDERING CODE
V 1122	TRANSISTOR	BF324	4822 130 41448
V 1123	DIODE,REFERENCE	BZX79-C5V6	4822 130 34173
V 1124	TRANSISTOR	BF370	4822 130 42589
V 1161	DIODE	BAW62	4822 130 30613
V 1162	DIODE	BAW62	4822 130 30613
V 1163	TRANSISTOR	BF324	4822 130 41448
V 1164	TRANSISTOR	BF324	4822 130 41448
V 1200	DIODE	BZV86-C1V4	4822 130 81423
V 1201	TRANSISTOR	ON4401	5322 130 61498
V 1202	DIODE	BA483	4822 130 32656
V 1203	DIODE	BA483	4822 130 32656
V 1204	TRANSISTOR	BF199	4822 130 44154
V 1205	DIODE,REFERENCE	BZX79-C8V2	4822 130 34382
V 1206	TRANSISTOR	BF199	4822 130 44154
V 1207	TRANSISTOR	BF324	4822 130 41448
V 1208	DIODE,REFERENCE	BZX79-C5V6	4822 130 34173
V 1209	TRANSISTOR	BF199	4822 130 44154
V 1211	TRANSISTOR	BF324	4822 130 41448
V 1212	TRANSISTOR	BF324	4822 130 41448
V 1213	TRANSISTOR	BF324	4822 130 41448
V 2001	DIODE	BZV86-C2V0	4822 130 81424
V 2002	DIODE	BZV86-C2V0	4822 130 81424
V 2003	DIODE,REFERENCE	BZX79-C3V0	4822 130 31881
V 2101	DIODE	BZV86-C2V0	4822 130 81424
V 2102	DIODE	BZV86-C2V0	4822 130 81424
V 2103	DIODE,REFERENCE	BZX79-C3V0	4822 130 31881
V 2308	DIODE,REFERENCE	BZX79-C5V1	4822 130 34233
V 2309	DIODE,REFERENCE	BZX79-C5V1	4822 130 34233
V 2310	TRANSISTOR	BC558B	4822 130 44197
V 2312	TRANSISTOR,CHIP	BC858B	5322 130 41983
V 2313	DIODE,CHIP	BAV99	5322 130 34337
V 2316	TRANSISTOR,CHIP	BF550R	4822 130 60687
V 2317	TRANSISTOR,CHIP	BC848C	5322 130 42136
V 2318	TRANSISTOR,CHIP	BF550	4822 130 42131
V 2319	TRANSISTOR,CHIP	BF550	4822 130 42131
V 2321	TRANSISTOR,CHIP	BF550R	4822 130 60687
V 2325	DIODE	BAW62	4822 130 30613
V 2326	DIODE	BAW62	4822 130 30613
V 2327	TRANSISTOR	BC558B	4822 130 44197
V 2328	DIODE,REFERENCE	BZX79-C5V1	4822 130 34233
V 2329	DIODE,REFERENCE	BZX79-C9V1	4822 130 30862
V 2331	TRANSISTOR	BC558B	4822 130 44197
V 2332	TRANSISTOR	BC558B	4822 130 44197
V 2333	TRANSISTOR	BC558B	4822 130 44197
V 2334	TRANSISTOR	BC558B	4822 130 44197
V 2341	TRANSISTOR	BF199	4822 130 44154
V 2342	TRANSISTOR	BF199	4822 130 44154
V 2347	TRANSISTOR	BF199	4822 130 44154
V 2349	TRANSISTOR	BF199	4822 130 44154
V 2356	TRANSISTOR	BC548C	4822 130 44196
V 2357	TRANSISTOR	BC548C	4822 130 44196
V 2366	DIODE	BAW62	4822 130 30613
V 2367	DIODE	BAW62	4822 130 30613
V 2368	DIODE	BAW62	4822 130 30613
V 2369	DIODE	BAW62	4822 130 30613
V 2370	TRANSISTOR	BC548C	4822 130 44196
V 2371	TRANSISTOR	BC558B	4822 130 44197
V 2601	DIODE,REFERENCE	BZX79-C6V2	4822 130 34167
V 2602	TRANSISTOR	BC548C	4822 130 44196
V 2611	TRANSISTOR	BF199	4822 130 44154
V 2612	TRANSISTOR	BF199	4822 130 44154
V 2615	TRANSISTOR	BC548C	4822 130 44196
V 2616	DIODE	BZV86-C1V4	4822 130 81423
V 2801	TRANSISTOR,CHIP	BF550	4822 130 42131
V 2802	TRANSISTOR,CHIP	BF550R	4822 130 60687
V 2803	TRANSISTOR,CHIP	BF550	4822 130 42131
V 2804	TRANSISTOR,CHIP	BF550R	4822 130 60687
V 3001	TRANSISTOR	BF324	4822 130 41448
V 3002	TRANSISTOR	BF324	4822 130 41448
V 3003	TRANSISTOR	BC558B	4822 130 44197
V 3004	TRANSISTOR	BF324	4822 130 41448
V 3006	TRANSISTOR	BF324	4822 130 41448
V 3007	TRANSISTOR	BC548C	4822 130 44196
V 3008	TRANSISTOR	BF370	4822 130 42589
V 3009	TRANSISTOR	BF370	4822 130 42589
V 3011	TRANSISTOR	2N3866	5322 130 41799
V 3012	TRANSISTOR	2N3866	5322 130 41799
V 3013	DIODE,REFERENCE	BZX79-B27	4822 130 34379
V 3014	DIODE,REFERENCE	BZX79-B27	4822 130 34379
V 3016	DIODE	BAW62	4822 130 30613
V 3101	TRANSISTOR	BF324	4822 130 41448
V 3102	TRANSISTOR	BF324	4822 130 41448
V 3103	TRANSISTOR	BF324	4822 130 41448
V 3104	TRANSISTOR	BC558B	4822 130 44197
V 3106	TRANSISTOR	BF324	4822 130 41448
V 3108	TRANSISTOR	BF472	5322 130 42535
V 3109	TRANSISTOR	BF370	4822 130 42589
V 3111	TRANSISTOR	BF370	4822 130 42589
V 3112	TRANSISTOR	2N5551	5322 130 44491
V 3113	DIODE,REFERENCE	BZX79-B5V6	4822 130 34173
V 3114	TRANSISTOR	2N5551	5322 130 44491
V 3116	TRANSISTOR	BF472	5322 130 42535
V 3200	TRANSISTOR	BF370	4822 130 42589
V 3201	TRANSISTOR	BF370	4822 130 42589
V 3202	TRANSISTOR	2N5401	5322 130 42534
V 3203	TRANSISTOR	2N5551	5322 130 44491
V 3204	TRANSISTOR	BF423	4822 130 41646
V 3205	DIODE,REFERENCE	BZX79-B5V6	4822 130 34173
V 3206	DIODE	BAW62	4822 130 30613
V 3207	TRANSISTOR	BC548C	4822 130 44196
V 3208	TRANSISTOR	BF423	4822 130 41646
V 3209	DIODE	BAW62	4822 130 30613
V 3211	DIODE	BAW62	4822 130 30613
V 3212	DIODE,REFERENCE	BZX79-B68	4822 130 30864
V 3213	TRANSISTOR	BC548C	4822 130 44196
V 3214	DIODE	BAW62	4822 130 30613
V 3215	DIODE	BAW62	4822 130 30613
V 3216	DIODE,REFERENCE	BZX79-C9V1	4822 130 30862
V 3217	DIODE	BAW62	4822 130 30613
V 3251	TRANSISTOR	BF423	4822 130 41646
V 3252	DIODE,REFERENCE	BZX79-C6V2	4822 130 34167
V 3253	TRANSISTOR	BF423	4822 130 41646
V 3254	TRANSISTOR	BF423	4822 130 41646

POSNR	DESCRIPTION		ORDERING CODE
V 3256	TRANSISTOR	BF423	4822 130 41646
V 3257	DIODE	BAV21	4822 130 30842
V 3301	DIODE,REFERENCE	BZX79-C6V2	4822 130 34167
V 4001	TRANSISTOR	BF199	4822 130 44154
V 4002	TRANSISTOR	BF199	4822 130 44154
V 4003	TRANSISTOR	BF324	4822 130 41448
V 4004	TRANSISTOR	BF324	4822 130 41448
V 4005	DIODE,REFERENCE	BZX79-C6V2	4822 130 34167
V 4006	DIODE	BAW62	4822 130 30613
V 4008	TRANSISTOR	BFQ22S	5322 130 42031
V 4009	TRANSISTOR	BC548C	4822 130 44196
V 4011	TRANSISTOR	BC548C	4822 130 44196
V 4012	TRANSISTOR	BC548C	4822 130 44196
V 4013	DIODE,REFERENCE	BZX79-C5V1	4822 130 34233
V 4014	TRANSISTOR	BC548C	4822 130 44196
V 4016	DIODE,REFERENCE	BZX79-C3V6	5322 130 34834
V 4017	DIODE	BAW62	4822 130 30613
V 4018	TRANSISTOR	BC548C	4822 130 44196
V 4021	TRANSISTOR	BC548C	4822 130 44196
V 4022	DIODE	BAW62	4822 130 30613
V 4023	TRANSISTOR	BC548C	4822 130 44196
V 4101	TRANSISTOR	BC558B	4822 130 44197
V 4102	DIODE	BAW62	4822 130 30613
V 4103	DIODE	BAW62	4822 130 30613
V 4104	TRANSISTOR	BC548C	4822 130 44196
V 4106	DIODE	BAW62	4822 130 30613
V 4107	TRANSISTOR	BC327	4822 130 40854
V 4108	TRANSISTOR	BC548C	4822 130 44196
V 4109	TRANSISTOR	BC558B	4822 130 44197
V 4111	TRANSISTOR	BC558B	4822 130 44197
V 4112	TRANSISTOR	BSX20	4822 130 41705
V 4113	DIODE	BZV86-C1V4	4822 130 81423
V 4114	TRANSISTOR	BSX20	4822 130 41705
V 4115	DIODE,REFERENCE	BZX79-C6V2	4822 130 34167
V 4116	DIODE	BAW62	4822 130 30613
V 4117	TRANSISTOR	BC548C	4822 130 44196
V 4118	TRANSISTOR	BC548C	4822 130 44196
V 4119	TRANSISTOR	BF199	4822 130 44154
V 4120	DIODE	BAW62	4822 130 30613
V 4121	TRANSISTOR	BC548C	4822 130 44196
V 4122	DIODE	BAW62	4822 130 30613
V 4123	DIODE	BAW62	4822 130 30613
V 4216	DIODE	BAW62	4822 130 30613
V 4217	TRANSISTOR	BC548C	4822 130 44196
V 4300	DIODE,REFERENCE	BZX79-C6V2	4822 130 34167
V 4301	TRANSISTOR	BC558B	4822 130 44197
V 4302	TRANSISTOR	BC548C	4822 130 44196
V 4304	TRANSISTOR	BC558B	4822 130 44197
V 4305	DIODE,REFERENCE	BZX79-C9V1	4822 130 30862
V 4306	DIODE	BAW62	4822 130 30613
V 4307	TRANSISTOR	BC548C	4822 130 44196
V 4308	DIODE	BZV86-C1V4	4822 130 81423
V 4309	TRANSISTOR	BC548C	4822 130 44196
V 4321	DIODE	BAW62	4822 130 30613
V 4322	TRANSISTOR	BC548C	4822 130 44196
V 4323	TRANSISTOR	BC548C	4822 130 44196
V 4500	DIODE	BAW62	4822 130 30613
V 4501	TRANSISTOR	BC548C	4822 130 44196
V 4502	TRANSISTOR	BC548C	4822 130 44196
V 4503	TRANSISTOR	BC548C	4822 130 44196
V 4504	TRANSISTOR	BC548C	4822 130 44196
V 4505	DIODE	BAW62	4822 130 30613
V 4506	TRANSISTOR	BC548C	4822 130 44196
V 4510	TRANSISTOR	BC558B	4822 130 44197
V 4511	TRANSISTOR	BC558B	4822 130 44197
V 4512	TRANSISTOR	BC558B	4822 130 44197
V 4513	TRANSISTOR	BC558B	4822 130 44197
V 4514	TRANSISTOR	BC558B	4822 130 44197
V 4516	DIODE	BAW62	4822 130 30613
V 4517	DIODE	BAW62	4822 130 30613
V 4518	DIODE	BAW62	4822 130 30613
V 4519	DIODE	BAW62	4822 130 30613
V 4521	DIODE	BAW62	4822 130 30613
V 4522	DIODE	BAW62	4822 130 30613
V 4523	TRANSISTOR	BC548C	4822 130 44196
V 4601	DIODE	BAW62	4822 130 30613
V 4602	DIODE	BAW62	4822 130 30613
V 4603	DIODE	BAW62	4822 130 30613
V 4611	TRANSISTOR	BF199	4822 130 44154
V 4612	TRANSISTOR	BF199	4822 130 44154
V 4613	DIODE	BAW62	4822 130 30613
V 4614	DIODE	BAW62	4822 130 30613
V 4616	TRANSISTOR	BC548C	4822 130 44196
V 4617	DIODE	BAW62	4822 130 30613
V 4618	DIODE	BAW62	4822 130 30613
V 4702	TRANSISTOR	BF324	4822 130 41448
V 4703	DIODE	BAW62	4822 130 30613
V 4704	DIODE	BAW62	4822 130 30613
V 4706	TRANSISTOR	BF324	4822 130 41448
V 4707	TRANSISTOR	BC558B	4822 130 44197
V 4708	TRANSISTOR	BF324	4822 130 41448
V 4709	TRANSISTOR	BC558B	4822 130 44197
V 4710	TRANSISTOR	BC548C	4822 130 44196
V 4711	DIODE	BAW62	4822 130 30613
V 4712	TRANSISTOR	BF324	4822 130 41448
V 4713	DIODE	BAW62	4822 130 30613
V 5101	TRANSISTOR,CHIP	BC858B	5322 130 41983
V 5102	DIODE,CHIP	BZX84-C3V6	5322 130 32731
V 5103	DIODE,CHIP	BAV99	5322 130 34337
V 5104	TRANSISTOR,CHIP	BFR92R	5322 130 44606
V 5106	TRANSISTOR,CHIP	BFS20	5322 130 42718
V 5111	TRANSISTOR,CHIP	BC858B	5322 130 41983
V 5112	DIODE,CHIP	BZX84-C3V6	5322 130 32731
V 5113	DIODE,CHIP	BAV99	5322 130 34337
V 5114	TRANSISTOR,CHIP	BFR92R	5322 130 44606
V 5116	TRANSISTOR,CHIP	BFS20	5322 130 42718
V 5121	TRANSISTOR,CHIP	BFR92R	5322 130 44606
V 5122	TRANSISTOR,CHIP	BC858B	5322 130 41983
V 5123	DIODE,CHIP	BAT17	5322 130 31544
V 5131	TRANSISTOR,CHIP	BFR92	5322 130 42145
V 5132	TRANSISTOR,CHIP	BFQ67	5322 130 42567
V 5133	DIODE,CHIP	BAT17	5322 130 31544
V 5134	DIODE,CHIP	BAT17	5322 130 31544

POSNR	DESCRIPTION		ORDERING CODE
V 5201	DIODE,CHIP	BZX84-C3V0	5322 130 32739
V 5211	TRANSISTOR,CHIP	BSV52	5322 130 44336
V 5212	TRANSISTOR,CHIP	BSV52	5322 130 44336
V 5221	TRANSISTOR,CHIP	BC858B	5322 130 41983
V 5222	TRANSISTOR,CHIP	BFT92	5322 130 44711
V 5223	TRANSISTOR	BFT92R	5322 130 44713
V 5224	TRANSISTOR	BFT92R	5322 130 44713
V 5226	TRANSISTOR,CHIP	BFT92	5322 130 44711
V 5227	TRANSISTOR,CHIP	BC858B	5322 130 41983
V 5261	DIODE,CHIP	BAV99	5322 130 34337
V 5262	TRANSISTOR,CHIP	BFR92R	5322 130 44606
V 5263	TRANSISTOR,CHIP	BFT92	5322 130 44711
V 5271	TRANSISTOR,CHIP	BC848C	5322 130 42136
V 5301	TRANSISTOR	BFR96S/02	5322 130 42244
V 5302	TRANSISTOR	BFR96S/02	5322 130 42244
V 5303	TRANSISTOR,CHIP	BCX54-16	5322 130 62237
V 5351	TRANSISTOR	BFR96S/02	5322 130 42244
V 5352	TRANSISTOR	BFR96S/02	5322 130 42244
V 5353	TRANSISTOR,CHIP	BF550R	4822 130 60687
V 5354	TRANSISTOR,CHIP	BF550	4822 130 42131
V 5356	TRANSISTOR,CHIP	BCX54-16	5322 130 62237
V 5401	TRANSISTOR	BFR96S/02	5322 130 42244
V 5402	TRANSISTOR	BFR96S/02	5322 130 42244
V 5403	TRANSISTOR,CHIP	BCX54-16	5322 130 62237
V 5451	TRANSISTOR	BFR96S/02	5322 130 42244
V 5452	TRANSISTOR	BFR96S/02	5322 130 42244
V 5453	TRANSISTOR,CHIP	BF550R	4822 130 60687
V 5454	TRANSISTOR,CHIP	BF550	4822 130 42131
V 5456	TRANSISTOR,CHIP	BCX54-16	5322 130 62237
V 5501	DIODE,CHIP	BAV99	5322 130 34337
V 5503	TRANSISTOR,CHIP	BFS20R	5322 130 44177
V 5504	TRANSISTOR,CHIP	BFS20	5322 130 42718
V 5506	TRANSISTOR,CHIP	BFR92R	5322 130 44606
V 5507	TRANSISTOR,CHIP	BFR92	5322 130 42145
V 5508	TRANSISTOR,CHIP	BC858B	5322 130 41983
V 5551	DIODE,CHIP	BAV99	5322 130 34337
V 5553	TRANSISTOR,CHIP	BFS20R	5322 130 44177
V 5554	TRANSISTOR,CHIP	BFS20	5322 130 42718
V 5556	TRANSISTOR,CHIP	BFR92R	5322 130 44606
V 5557	TRANSISTOR,CHIP	BFR92	5322 130 42145
V 5558	TRANSISTOR,CHIP	BC858B	5322 130 41983
V 5601	DIODE,REFERENCE	BZV11	5322 130 34294
V 5602	TRANSISTOR,CHIP	BC858B	5322 130 41983
V 5603	TRANSISTOR,CHIP	BC858B	5322 130 41983
V 5604	TRANSISTOR,CHIP	BF550	4822 130 42131
V 5606	TRANSISTOR,CHIP	BF550	4822 130 42131
V 5607	TRANSISTOR,CHIP	BF550R	4822 130 60687
V 5609	TRANSISTOR,CHIP	BF550R	4822 130 60687
V 5651	TRANSISTOR,CHIP	BC848C	5322 130 42136
V 5671	TRANSISTOR,CHIP	BC848C	5322 130 42136
V 5672	TRANSISTOR,CHIP	BC848C	5322 130 42136
V 5673	TRANSISTOR,CHIP	BC848C	5322 130 42136
V 5674	TRANSISTOR,CHIP	BC848C	5322 130 42136
V 5702	TRANSISTOR,CHIP	BC858B	5322 130 41983
V 5703	TRANSISTOR,CHIP	BC858B	5322 130 41983
V 5704	TRANSISTOR,CHIP	BF550	4822 130 42131
V 5706	TRANSISTOR,CHIP	BF550	4822 130 42131
V 5707	TRANSISTOR,CHIP	BF550R	4822 130 60687
V 5709	TRANSISTOR,CHIP	BF550R	4822 130 60687
V 5751	TRANSISTOR,CHIP	BC848C	5322 130 42136
V 5771	TRANSISTOR,CHIP	BC848C	5322 130 42136
V 5772	TRANSISTOR,CHIP	BC848C	5322 130 42136
V 5773	TRANSISTOR,CHIP	BC848C	5322 130 42136
V 5774	TRANSISTOR,CHIP	BC848C	5322 130 42136
V 5803	TRANSISTOR,FET	BFQ13	5322 130 44404
V 5808	TRANSISTOR,FET	BFQ13	5322 130 44404
V 5813	TRANSISTOR,FET	BFQ13	5322 130 44404
V 5818	TRANSISTOR,FET	BFQ13	5322 130 44404
V 5892	DIODE	BZV86-C2V0	4822 130 81424
V 5901	DIODE,CHIP	BZX84-C5V1	5322 130 32835
V 5902	DIODE,CHIP	BZX84-B27	5322 130 82039
V 5903	TRANSISTOR,CHIP	BC848C	5322 130 42136
V 5906	TRANSISTOR,CHIP	BC858B	5322 130 41983
V 6001	DIODE	BYV96E	5322 130 34979
V 6002	DIODE	BYV96E	5322 130 34979
V 6003	DIODE	BYV96E	5322 130 34979
V 6004	DIODE	BYV96E	5322 130 34979
V 6007	DIODE	BAX12	5322 130 34605
V 6008	DIODE	BAX12	5322 130 34605
V 6009	TRANSISTOR	BC337	4822 130 40855
V 6011	DIODE	BAX12	5322 130 34605
V 6012	DIODE,REFERENCE	BZX79-C15	4822 130 34281
V 6013	THYRISTOR	BRY39	5322 130 40482
V 6014	TRANSISTOR	BUZ80	5322 130 42816
V 6016	DIODE	BYV27-150	4822 130 31628
V 6017	DIODE	BYV96E	5322 130 34979
V 6018	TRANSISTOR	BUW12A	5322 130 42114
V 6019	DIODE	BYV26C	4822 130 32343
V 6021	DIODE,REFERENCE	BZX79-C3V0	4822 130 31881
V 6031	DIODE,REFERENCE	BZX79-C3V6	5322 130 34834
V 6101	DIODE	MBR2545CT	5322 130 81179
V 6102	DIODE	MBR1045	5322 130 82041
V 6104	DIODE	BYV28-150	5322 130 32043
V 6106	DIODE	BYV28-150	5322 130 32043
V 6107	DIODE	BYV95C	4822 130 41487
V 6108	DIODE	BYV27-150	4822 130 31628
V 6109	DIODE	BYV95C	4822 130 41487
V 6110	DIODE	BYV27-150	4822 130 31628
V 6113	DIODE	BYV95C	4822 130 41487
V 6115	DIODE	BYV27-150	4822 130 31628
V 6116	DIODE	BYV27-150	4822 130 31628
V 6131	DIODE	BAX12	5322 130 34605
V 6132	DIODE	BAW62	4822 130 30613
V 6133	DIODE,REFERENCE	BZX79-C6V2	4822 130 34167
V 6134	TRANSISTOR	BC337	4822 130 40855
V 6136	TRANSISTOR	BF423	4822 130 41646
V 6137	TRANSISTOR	BF423	4822 130 41646
V 6138	DIODE,REFERENCE	BZX79-C5V6	4822 130 34173
V 6201	TRANSISTOR	BC327	4822 130 40854
V 6202	DIODE,REFERENCE	BZX79-C15	4822 130 34281
V 6203	DIODE	BAV21	4822 130 30842
V 6204	DIODE	BAV21	4822 130 30842
V 6206	DIODE	BAV21	4822 130 30842
V 6207	DIODE	BYV27-150	4822 130 31628
V 6208	TRANSISTOR	BUV26A	5322 130 42722
V 6209	DIODE	BY509	4822 130 41485
V 6211	TRANSISTOR	BC337	4822 130 40855
V 6301	TRANSISTOR	BC548C	4822 130 44196
V 6302	TRANSISTOR	BC558B	4822 130 44197
V 6303	TRANSISTOR	BC337	4822 130 40855
V 6304	TRANSISTOR	BC327	4822 130 40854
V 6311	TRANSISTOR	BC337	4822 130 40855
V 6312	TRANSISTOR	BDX78	5322 130 44278
V 6401	DIODE,REFERENCE	BZV11	5322 130 34294
V 6402	DIODE	BAX12	5322 130 34605
V 6403	TRANSISTOR	BC337	4822 130 40855

25.4.5 INTEGRATED CIRCUITS

POSNR	DESCRIPTION		ORDERING CODE	
D 801	INTEGR.CIRCUIT	OQ 0206N3	5322 209 11606	
D 0201	INTEGR.CIRCUIT	74F138PC	5322 209 82366	
D 0202	INTEGR.CIRCUIT	PC74HCT138P	5322 209 11111	
D 0203	INTEGR.CIRCUIT	PC74HCT132P	4822 209 83044	
D 0204	INTEGR.CIRCUIT	PC74HCT390P	5322 209 11483	
D 0206	INTEGR.CIRCUIT	PC74HCT390P	5322 209 11483	
D 0207	INTEGR.CIRCUIT	C74HCT4040P	5322 209 72465	
D 0208	INTEGR.CIRCUIT	PC74HCT10P	5322 209 11107	
D 0209	INTEGR.CIRCUIT	74F11PC	5322 209 81536	
D 0211	INTEGR.CIRCUIT	74F02PC	5322 209 81535	
D 0212	INTEGR.CIRCUIT	74F04PC	5322 209 81577	
D 0213	I.C. ANALOGUE	PC74HCT32P	5322 209 11266	
D 0214	INTEGR.CIRCUIT	MC68008P8	5322 209 11593	
D 0216	I.C. E-PROM	C010-200V10	5322 209 51835	
D 0217	INTEGR.CIRCUIT	M62256LP-12	5322 209 72129	
D 0218	INTEGR.CIRCUIT	P8254	5322 209 82406	
D 0219	INTEGR.CIRCUIT	PC74HCT259P	5322 209 11115	
D 0221	INTEGR.CIRCUIT	PC74HCT244P	5322 209 11116	
D 0222	INTEGR.CIRCUIT	PC74HCT259P	5322 209 11115	
D 0223	INTEGR.CIRCUIT	PC74HCT03P	5322 209 11316	
D 0301	INTEGR.CIRCUIT	PC74HCT244P	5322 209 11116	
D 0302	INTEGR.CIRCUIT	PC74HCT244P	5322 209 11116	
D 0303	INTEGR.CIRCUIT	PC74HCT245P	5322 209 11117	
D 0304	INTEGR.CIRCUIT	M62256LP-12	5322 209 72129	
D 0306	INTEGR.CIRCUIT	OQ 0209	5322 209 11603	
D 0307	INTEGR.CIRCUIT	PC74HCT86P	5322 209 11473	
D 0308	INTEGR.CIRCUIT	M6264ALP-12	5322 209 60192	
D 0309	INTEGR.CIRCUIT	OQ 0209	5322 209 11603	
D 0311	INTEGR.CIRCUIT	PC74HCT174P	5322 209 11478	
D 0312	INTEGR.CIRCUIT	PC74HCT174P	5322 209 11478	
D 0313	INTEGR.CIRCUIT	PC74HCT259P	5322 209 11115	
D 0314	INTEGR.CIRCUIT	CB1536RC	5322 209 72515	
D 0316	INTEGR.CIRCUIT	PC74HCT138P	5322 209 11111	
D 0318	INTEGR.CIRCUIT	HEF4066BP	5322 209 10357	
D 0401	INTEGR.CIRCUIT	PC74HCT04P	4822 209 82341	
D 0402	INTEGR.CIRCUIT	PC74HCT74P	5322 209 11109	
D 0403	INTEGR.CIRCUIT	PC74HCT74P	5322 209 11109	
D 0404	INTEGR.CIRCUIT	74F112PC	5322 209 70101	
D 0406	INTEGR.CIRCUIT	PC74HCT00P	5322 209 11105	
D 0407	I.C. ANALOGUE	PC74HCT08P	5322 209 11265	
D 0408	INTEGR.CIRCUIT	PC74HCT10P	5322 209 11107	
D 0409	I.C. ANALOGUE	PC74HCT163P	5322 209 11267	
D 0411	I.C. ROM	AL16R8A-2CN	5322 209 51424	
D 0412	INTEGR.CIRCUIT	PCF1106P/029	5322 209 72941	
D 0413	INTEGR.CIRCUIT	PC74HCT574P	5322 209 11489	
D 0416	I.C. ANALOGUE	PC74HCT08P	5322 209 11265	
D 0431	I.C. ROM	AL16R8A-2CN	5322 209 51424	
D 0432	INTEGR.CIRCUIT	PC74HCT00P	5322 209 11105	
D 0433	INTEGR.CIRCUIT	PC74HCT74P	5322 209 11109	
D 0434	I.C. ANALOGUE	PC74HCT157P	5322 209 11263	
D 0437	I.C. ANALOGUE	PC74HCT157P	5322 209 11263	
D 0441	INTEGR.CIRCUIT	74F191PC	5322 209 81676	
D 0442	INTEGR.CIRCUIT	PC74HCT191P	5322 209 11481	
D 0443	INTEGR.CIRCUIT	PC74HCT191P	5322 209 11481	
D 0444	INTEGR.CIRCUIT	PC74HCT191P	5322 209 11481	
D 0446	INTEGR.CIRCUIT	PC74HCT20P	5322 209 11471	
D 0503	INTEGR.CIRCUIT	C74HCT4053P	4822 209 71584	
D 0504	INTEGR.CIRCUIT	HEF4104BP	4822 209 10273	
D 0505	INTEGR.CIRCUIT	HEF4066BP	5322 209 10357	
D 0512	INTEGR.CIRCUIT	C74HCT4053P	4822 209 71584	
D 0601	INTEGR.CIRCUIT	PLIFIER	5322 209 80991	
D 0602	INTEGR.CIRCUIT	PLIFIER	5322 209 80991	
D 0603	INTEGR.CIRCUIT	C74HCT4053P	4822 209 71584	
D 0801	INTEGR.CIRCUIT	OQ 0210	5322 209 11604	
D 0876	INTEGR.CIRCUIT	74F08PC	5322 209 81574	
D 0887	INTEGR.CIRCUIT	PC74HCT160P	5322 209 72516	
D 0901	INTEGR.CIRCUIT	C74HCT4052P	4822 209 71583	(PM3350A ONLY)
D 0903	INTEGR.CIRCUIT	HEF4066BP	5322 209 10357	
D 0904	INTEGR.CIRCUIT	HEF4066BP	5322 209 10357	
D 0911	INTEGR.CIRCUIT	C74HCT4052P	4822 209 71583	(PM3350A ONLY)
D 0914	INTEGR.CIRCUIT	HEF4066BP	5322 209 10357	
D 0921	INTEGR.CIRCUIT	HEF4104BP	4822 209 10273	(PM3350A ONLY)
D 0922	I.C. ANALOGUE	PC74HCT08P	5322 209 11265	(PM3350A ONLY)
D 0901	INTEGR.CIRCUIT	C74HCT4052T	5322 209 61132	
D 0911	INTEGR.CIRCUIT	C74HCT4052T	5322 209 61132	
D 0921	INTEGR.CIRCUIT	HEF4104BT	5322 209 11304	
D 0922	INTEGR.CIRCUIT	PC74HCT08T	5322 209 11596	
D 1001	INTEGR.CIRCUIT	TEA1017/N9	5322 209 60191	
D 1061	INTEGR.CIRCUIT	OQ 0221N2	5322 209 11878	
D 1101	INTEGR.CIRCUIT	TEA1017/N9	5322 209 60191	
D 1161	INTEGR.CIRCUIT	OQ 0221N2	5322 209 11878	
D 2002	INTEGR.CIRCUIT	OQ 0205N2	5322 209 73576	
D 2102	INTEGR.CIRCUIT	OQ 0205N2	5322 209 73576	

POSNR	DESCRIPTION		ORDERING CODE
D 2201	INTEGR.CIRCUIT	OQ 0020	5322 209 80991
D 2202	INTEGR.CIRCUIT	OQ 0020	5322 209 80991
D 2301	INTEGR.CIRCUIT	OQ 0205N2	5322 209 73576
D 2302	INTEGR.CIRCUIT	PLIFIER	5322 209 80991
D 2303	INTEGR.CIRCUIT	PLIFIER	5322 209 80991
D 2304	INTEGR.CIRCUIT	OQ 0128	5322 209 82925
D 2601	INTEGR.CIRCUIT	HEF4053BP	5322 209 10576
D 2602	INTEGR.CIRCUIT	TEA1017/N9	5322 209 60191
D 2603	INTEGR.CIRCUIT	OQ 0200	5322 209 82924
D 2802	INTEGR.CIRCUIT	PCF8574T	5322 209 11578
D 4001	INTEGR.CIRCUIT	TEA1017/N9	5322 209 60191
D 4002	INTEGR.CIRCUIT	TEA1017/N9	5322 209 60191
D 4101	INTEGR.CIRCUIT	HEF4053BP	5322 209 10576
D 4102	INTEGR.CIRCUIT	HEF4051BP	4822 209 10262
D 4103	INTEGR.CIRCUIT	OQ 0201	5322 209 70391
D 5202	INTEGR.CIRCUIT	N74F08D	5322 209 61002
D 5601	INTEGR.CIRCUIT	OQ 0204 SEL	5322 209 62373
D 5701	INTEGR.CIRCUIT	OQ 0204 SEL	5322 209 62373
D 5802	INTEGR.CIRCUIT	HEF4066BT	5322 209 14542
D 5803	INTEGR.CIRCUIT	HEF4066BT	5322 209 14542
D 5804	INTEGR.CIRCUIT	HEF4066BT	5322 209 14542
D 5806	INTEGR.CIRCUIT	HEF4053BT	5322 209 14481
D 5807	INTEGR.CIRCUIT	HEF4053BT	5322 209 14481
D 5814	INTEGR.CIRCUIT	HEF4066BT	5322 209 14542
D 6201	CABLE,CONNECT.	BG2000-641-505	5322 321 21597
D 6501	INTEGR.CIRCUIT	HEF4066BP	5322 209 10357
D 7001	INTEGR.CIRCUIT	PCF8574P	5322 209 10883
D 7002	INTEGR.CIRCUIT	PCF8574P	5322 209 10883
D 7003	INTEGR.CIRCUIT	PCF8574P	5322 209 10883
D 7004	INTEGR.CIRCUIT	OQ 0044	5322 209 11008
D 8001	INTEGR.CIRCUIT	PCF8577T	5322 209 70024
D 8002	INTEGR.CIRCUIT	PCF8577T	5322 209 70024
D 8003	INTEGR.CIRCUIT	PCF8577T	5322 209 70024
N 0201	INTEGR.CIRCUIT	LM393N	4822 209 80797
N 0501	INTEGR.CIRCUIT	LF356N	5322 209 86451
N 0502	INTEGR.CIRCUIT	LF356N	5322 209 86451
N 0503	INTEGR.CIRCUIT	TL082CP	5322 209 86064
N 0504	INTEGR.CIRCUIT	LM358N	4822 209 70672
N 0505	INTEGR.CIRCUIT	AD7824KN	5322 209 72942
N 0506	INTEGR.CIRCUIT	DAC-08EP	5322 209 11253
N 0507	INTEGR.CIRCUIT	DAC10FX	5322 209 71665
N 0511	INTEGR.CIRCUIT	LF356N	5322 209 86451
N 0512	INTEGR.CIRCUIT	LM358N	4822 209 70672
N 0513	INTEGR.CIRCUIT	TL082CP	5322 209 86064
N 0601	INTEGR.CIRCUIT	LM324N	4822 209 80587
N 0701	INTEGR.CIRCUIT	LM358D	5322 209 82941
N 0901	INTEGR.CIRCUIT	TL082CP	5322 209 86064
N 0904	INTEGR.CIRCUIT	TL082CP	5322 209 86064
N 0905	INTEGR.CIRCUIT	TL082CP	5322 209 86064
N 0913	INTEGR.CIRCUIT	TL082CP	5322 209 86064
N 0914	INTEGR.CIRCUIT	TL082CP	5322 209 86064
N 0921	INTEGR.CIRCUIT	LM358N	4822 209 70672
N 0922	INTEGR.CIRCUIT	LM358N	4822 209 70672
N 0927	INTEGR.CIRCUIT	TL082CP	5322 209 86064
N 0947	INTEGR.CIRCUIT	TL082CP	5322 209 86064
N 0987	INTEGR.CIRCUIT	LM337LZ	5322 209 83228
N 0988	INTEGR.CIRCUIT	LM337T	5322 209 81236
N 0989	INTEGR.CIRCUIT	LM317LZ	5322 209 82943
N 1001	TRANSISTOR	OP-77GP	5322 130 60937
N 1101	TRANSISTOR	OP-77GP	5322 130 60937
N 1201	INTEGR.CIRCUIT	LF356N	5322 209 86451
N 2203	INTEGR.CIRCUIT	CA3227E	5322 209 72568
N 4101	INTEGR.CIRCUIT	LM324N	4822 209 80587
N 4102	TRANSISTOR	OP-77GP	5322 130 60937
N 4103	INTEGR.CIRCUIT	TL080CP	5322 209 72464
N 4601	INTEGR.CIRCUIT	CA3102E	5322 209 72657
N 5101	INTEGR.CIRCUIT	LM358D	5322 209 82941
N 5501	INTEGR.CIRCUIT	LM358D	5322 209 82941
N 5551	INTEGR.CIRCUIT	LM358D	5322 209 82941
N 5601	INTEGR.CIRCUIT	LM358D	5322 209 82941
N 5701	INTEGR.CIRCUIT	LM358D	5322 209 82941
N 5801	INTEGR.CIRCUIT	TL082CD	5322 209 72002
N 5804	INTEGR.CIRCUIT	TL082CD	5322 209 72002
N 5805	INTEGR.CIRCUIT	TL082CD	5322 209 72002
N 5813	INTEGR.CIRCUIT	TL082CD	5322 209 72002
N 5814	INTEGR.CIRCUIT	TL082CD	5322 209 72002
N 5827	INTEGR.CIRCUIT	TL082CD	5322 209 72002
N 5847	INTEGR.CIRCUIT	TL082CD	5322 209 72002
N 5901	INTEGR.CIRCUIT	LM358D	5322 209 82941
N 5902	INTEGR.CIRCUIT	LM317T	4822 209 80591
N 5903	INTEGR.CIRCUIT	LM337LZ	5322 209 83228
N 5904	INTEGR.CIRCUIT	LM358D	5322 209 82941
N 6001	INTEGR.CIRCUIT	LM358N	4822 209 70672
N 6002	INTEGR.CIRCUIT	LM358N	4822 209 70672
N 7001	INTEGR.CIRCUIT	LM339AN	5322 209 60188
N 7002	INTEGR.CIRCUIT	LM324N	4822 209 80587
N 7003	INTEGR.CIRCUIT	LM324N	4822 209 80587

25.4.6 CATHODE RAY TUBE

POSNR	DESCRIPTION		ORDERING CODE
V 0001	TUBE,ELECTRON	D14-372GH	5322 131 20169

25.4.7 MISCELLANEOUS

POSNR	DESCRIPTION		ORDERING CODE
E 0001	LAMP	T13/4 28V 80MA	5322 134 40534
E 8001	LAMP	60MA MGG9012	5322 134 40849
G 0201	CRYSTAL	Q-0-100-16M S.R	5322 242 71445
H 6001	COUPLER,PHOTO	CNX35	5322 130 90137
H 8002	INTEGR.CIRCUIT	LPH1545-1	5322 209 60193
K 1001	RELAY,REED	DRELAIS IL 12 V	5322 280 20125
K 1002	RELAY,REED	DRELAIS IL 12 V	5322 280 20125
K 1003	RELAY,REED	DRELAIS IL 12 V	5322 280 20125
K 1004	RELAY,REED	DRELAIS IL 12 V	5322 280 20125
K 1006	RELAY,REED	DRELAIS IL 12 V	5322 280 20125
K 1007	RELAY,REED	DRELAIS IL 12 V	5322 280 20125
K 1008	RELAY,REED	DRELAIS IL 12 V	5322 280 20125
K 1101	RELAY,REED	DRELAIS IL 12 V	5322 280 20125
K 1102	RELAY,REED	DRELAIS IL 12 V	5322 280 20125
K 1103	RELAY,REED	DRELAIS IL 12 V	5322 280 20125
K 1104	RELAY,REED	DRELAIS IL 12 V	5322 280 20125
K 1106	RELAY,REED	DRELAIS IL 12 V	5322 280 20125
K 1107	RELAY,REED	DRELAIS IL 12 V	5322 280 20125
K 1108	RELAY,REED	DRELAIS IL 12 V	5322 280 20125
K 1201	RELAY,REED	DRELAIS IL 12 V	5322 280 20125
K 4101	RELAY,REED	DRELAIS IL 12 V	5322 280 20125
S 1901	SWITCH,PUSHBUT.	1-P 1VA 1MA	5322 276 12544
S 1902	SWITCH,PUSHBUT.	1-P 1VA 1MA	5322 276 12544
S 1903	SWITCH,PUSHBUT.	1-P 1VA 1MA	5322 276 12544
S 1904	SWITCH,PUSHBUT.	1-P 1VA 1MA	5322 276 12544
S 1905	SWITCH,PUSHBUT.	1-P 1VA 1MA	5322 276 12544
S 6001	SWITCH,PUSHBUT.		5322 276 11859
S 7001	SWITCH,TUMBLER	BR	5322 277 10878
S 7003	SWITCH,PUSHBUT.		5322 276 11857
S 7004	SWITCH,PUSHBUT.		5322 276 11856
S 7005	SWITCH,PUSHBUT.		5322 276 11856
S 7006	SWITCH,PUSHBUT.		5322 276 11856
S 7007	SWITCH,PUSHBUT.		5322 276 11856
S 7008	SWITCH,PUSHBUT.		5322 276 11856
S 7009	SWITCH,TUMBLER	BR	5322 277 10878
S 7011	SWITCH,PUSHBUT.		5322 276 11856
S 7012	SWITCH,PUSHBUT.		5322 276 11856
S 7013	SWITCH,PUSHBUT.		5322 276 11856
S 7014	SWITCH,TUMBLER	BR	5322 277 10878
S 7016	SWITCH,PUSHBUT.		5322 276 11856
S 7017	SWITCH,PUSHBUT.		5322 276 11856
S 7018	SWITCH,PUSHBUT.		5322 276 11856
S 7019	SWITCH,PUSHBUT.		5322 276 11856
S 7020	SWITCH,PUSHBUT.		5322 276 11856
S 7021	SWITCH,PUSHBUT.		5322 276 11856
S 7022	SWITCH,TUMBLER	BR	5322 277 10878
S 7025	SWITCH,PUSHBUT.		5322 276 11856
S 7026	SWITCH,PUSHBUT.		5322 276 11856
S 7027	SWITCH,TUMBLER	BR	5322 277 10878
S 7029	SWITCH,PUSHBUT.		5322 276 11856
S 7030	SWITCH,PUSHBUT.		5322 276 11856
S 7031	SWITCH,PUSHBUT.		5322 276 11856
S 7032	SWITCH,PUSHBUT.		5322 276 11856
S 7033	SWITCH,PUSHBUT.		5322 276 11856
S 7034	SWITCH,PUSHBUT.		5322 276 11856
S 7035	SWITCH,PUSHBUT.		5322 276 11856
T 6001	TRANSFORMER	TRANSFORMER	5322 146 21524
T 6201	TRANSFORMER	TRANSFORMER TFE 3015	5322 146 30592
	HS MULTIPLIER		5322 321 21597
G 0801	CRYSTAL 100 MHz		5322 242 71737
G 5101	CRYSTAL 100 MHz		5322 242 71737
G 5102	CRYSTAL 125 MHz		5322 242 71738

25.4.8 ADDITIONAL RESISTORS (PM3355/57 ONLY)

POSNR	DESCRIPTION		ORDERING CODE	
R 0862	RES.CHIP	MCR18 1% 2K2	4822 111 90248	(PM3375/77)
R 0882	RES.NETWORK	MCR18 1% 100E	5322 111 91134	(PM3375/77)
R 0883	RES.NETWORK	MCR18 1% 100E	5322 111 91134	(PM3375/77)
R 0884	RES.NETWORK	MCR18 1% 100E	5322 111 91134	(PM3375/77)
R 0886	RES.NETWORK	MCR18 1% 100E	5322 111 91134	(PM3375/77)
R 0927	RES.CHIP	RC-02H 1% 100E	5322 116 80426	(PM3375/77)
R 0937	RES.CHIP	RC-02H 1% 100E	5322 116 80426	(PM3375/77)
R 0947	RES.CHIP	RC-02H 1% 100E	5322 116 80426	(PM3375/77)
R 0957	RES.CHIP	RC-02H 1% 100E	5322 116 80426	(PM3375/77)